Power Engineering

FEBRUARY, 1953

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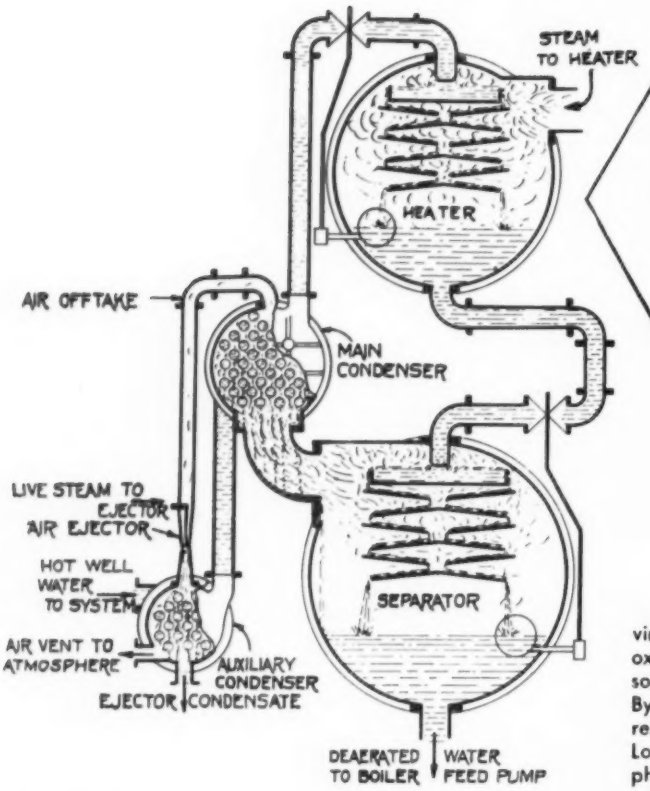
DEAERATION

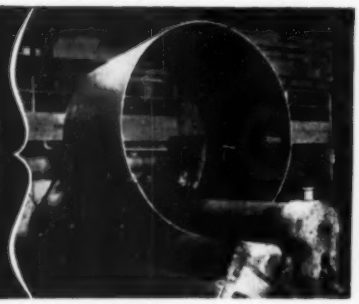


THE FIRST DEAERATOR, DEVELOPED AND BUILT BY ELLIOTT IN 1918

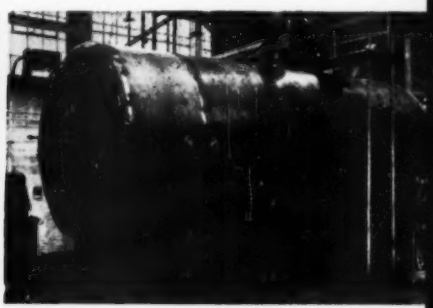
After much research and experimentation in the virgin field of processing feedwater for the removal of oxygen, Elliott engineers in 1918 developed, built and sold the first practical commercial deaerating unit. By 1924 the supreme value of the achievement was recognized in the award to W. S. Elliott of the Edward Longstreth medal by the Franklin Institute, Philadelphia . . . With this commanding lead, backed by valuable pioneering experience, Elliott engineers have continued to set the pace in deaeration development.

HOW ELLIOTT BUILDS DEAERATING HEATERS

All the work is done right in the Elliott shops. Rolling of shells, welding and fabricating of parts is all handled by Elliott personnel. It's actually custom tailoring in metal, for every unit is built . . . fit its job.



Rolling a fair-sized shell.



ASME-approved automatic welding is used wherever possible.

ELLIOTT Company

DEAERATOR AND HEATER DEPARTMENT

N2-2

has come a long way!

1952 THE ELLIOTT DEAERATING HEATER OF TODAY

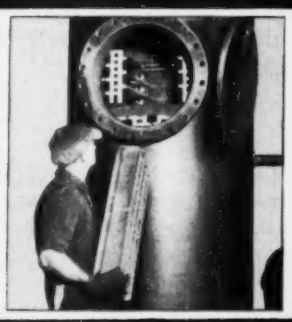
The modern Elliott deaerating heater combines the three stages of the deaerating process—heating, deaerating and venting—within a single shell, thus eliminating headroom problems and simplifying construction. The tubular vent condenser is replaced by a spray pipe and vent hood, both of stainless steel, which perform the functions of the clumsy, outmoded vent condenser with no maintenance other than occasional inspection. Here in itself is a major saving.

The entire heating section, and in fact all parts in contact with corrosive water, are of stainless steel. Trays, too, are of stainless steel—not only corrosion-free, but far lighter in weight—another factor for lower maintenance.

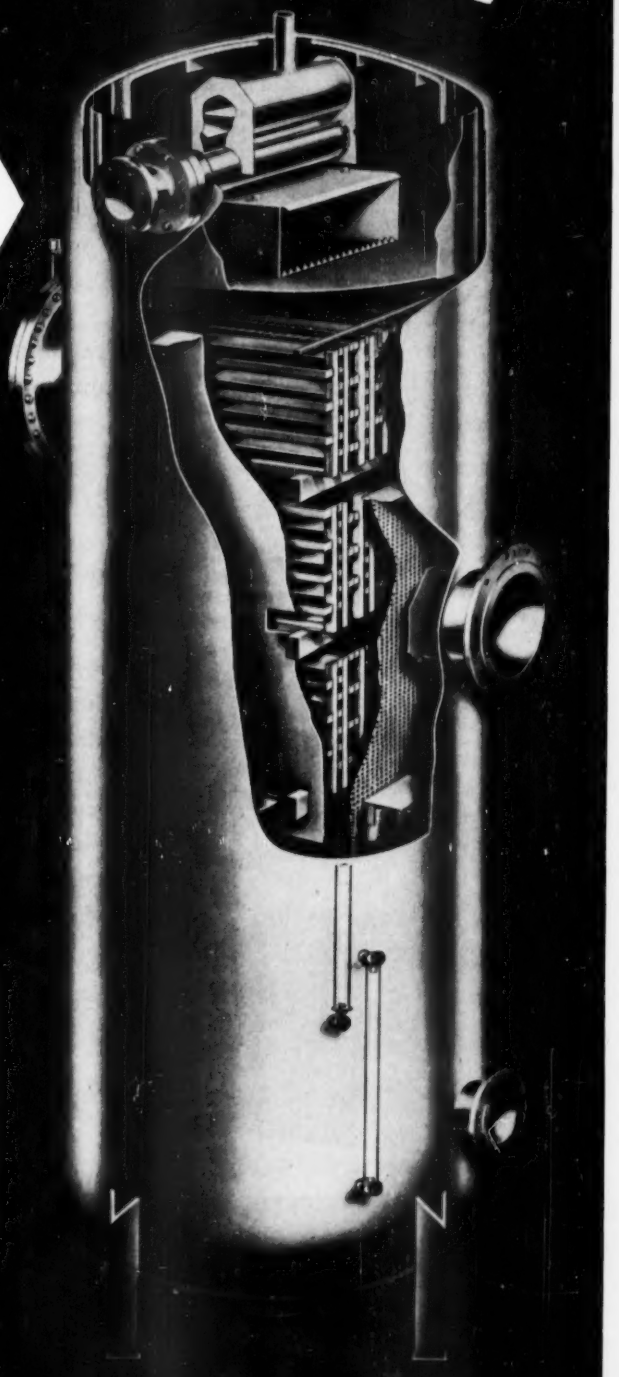
The picture at right shows the tray-type unit. The Elliott spray-type unit, developed largely for marine use, is also available.

For full details on Elliott deaerating heaters contact your local Elliott representative or write Elliott Company, Jeannette, Pa.

Tack-welding a baffle-plate in place before final welding.



Stainless steel trays are no burden at all in manual handling.



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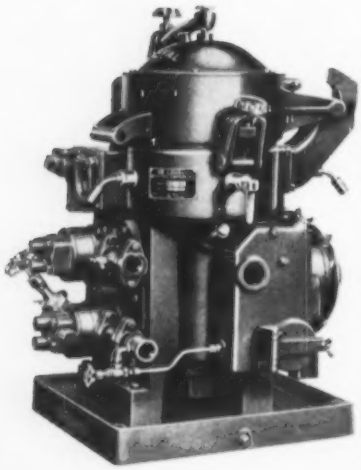
NO GETTING AROUND IT!

De Laval Oil Purifiers Give Double Protection

There's no avoiding the fact that a turbine requires protection from *two* troublemakers—dirt and water. Any device that removes only the dirt does only half a job.

That is why De Laval Oil Purifiers are so much more effective for maintaining the purity of turbine oil than any other means available. They not only remove solid contaminants but also any moisture that may be present.



It is important to get such ***double protection,*** for oftentimes water, rather than dirt, is the real source of contamination. For example, condensate in oil leads directly to the formation of sludge, and, of course, if a water leak should ever develop, serious emulsification and real trouble might occur.

De Laval Oil Purifiers do not remove oil-soluble additives. The purifying action is entirely mechanical.

THE DE LAVAL SEPARATOR COMPANY
Poughkeepsie, New York 427 Randolph St., Chicago 6
DE LAVAL PACIFIC CO., 61 Beale St., San Francisco 5
THE DE LAVAL COMPANY, Limited, Peterborough, Ont.

DE LAVAL

for more dependable power production

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FEBRUARY 1953
VOL. 57 • NO. 2

Welders joining ribs and sides of a section of the stator of the largest 3600 rpm generator ever built. General Electric is building this and three others

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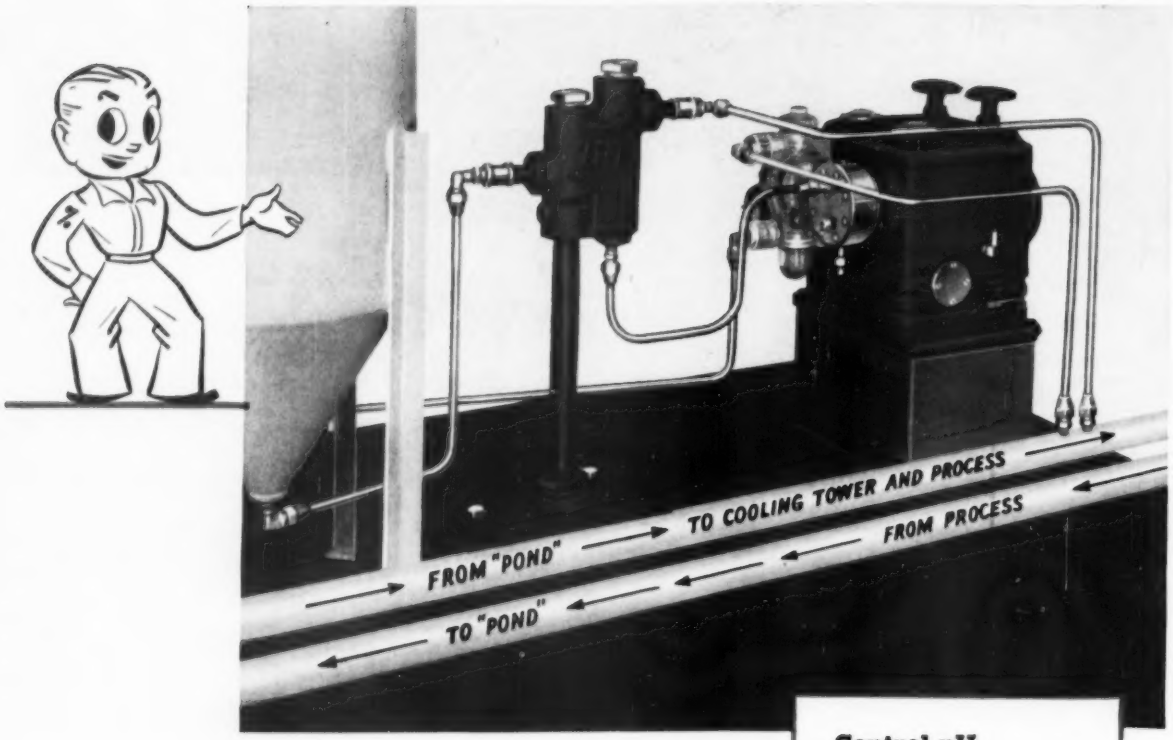
The only magazine devoted exclusively to the job interests of power engineers

HERE'S POSITIVE *Chemical Control* FOR YOUR COOLING WATER SYSTEM



Injection of treating chemicals into the line supplying water from the "pond" to the cooling tower prevents formation of slime and algae, and maintains the most efficient operating conditions throughout the cooling system. The chemicals are fed automatically at a constant, predetermined rate, or flow responsively in accordance with makeup demand. If a pH-responsive system is desired to maintain the optimum pH conditions, the metering pump can be readily adapted to this control. The Chem-O-Feeder in this "package" is a diaphragm-type unit, which can be supplied with one, two, or three measuring chambers, each having a maximum capacity of ten gallons per hour at pressures up to 100 psig. As many as three different chemicals can be handled at the same time. When equipped with an indirect displacement unit, the Chem-O-Feeder readily feeds hard-to-handle chemicals used in cooling water treatment.

Control pH

Prevent slime build-up

Eliminate down-time for cleaning

Increase cooling efficiency

Prolong equipment life

Reduce pumping costs

Ask for recommendations and descriptive literature

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Technical service representatives in principal cities of the United States, Canada, Mexico and other foreign countries.

For more data circle 503 on Post Card

ENGINEERS' PREVIEW

General Electric Company announced that Union Pacific Railroad of Omaha, Nebraska will place 15 gas turbine electric locomotives in service on their lines hauling fast freights in 1954. Addition of these 15 locomotives to the 10 previously ordered will give the Union Pacific 25 of these gas turbine powered giants.

The new gas turbine powered locomotives will develop 4500 hp, equivalent to an average three-unit diesel-electric freight locomotive. The new units will be about 83 feet long and will pull a heavily loaded freight train at speeds up to 65 mph.

★ ★ ★

Case Institute of Technology, Cleveland, electrical engineering students, next February will for the first time have the opportunity to enroll in a new motor design course wherein their own design efforts will actually be incorporated into manufactured motors. Normally such design courses are limited to paper work that cannot be checked by actual tests for performance and manufacturing practicability.

Under this new plan, small groups of students will work together in designing motors from one to 7½ hp. Their specifications will then be sent to Robbins and Myers, Inc., Springfield, Ohio, where the motors will be built at no charge. The company will then deliver the motors to Case where the students may check their work by actual tests that are rarely, if ever, possible in normal classroom procedure. The motors will become the property of Case as an adjunct to their regular laboratory equipment.

★ ★ ★

Riley Stoker Corporation of Worcester, Massachusetts, and John Brown and Company Limited of Sheffield, England, announce that an agreement has been concluded between them whereby Riley Steam Generating and Riley Fuel Burning Equipment will be manufactured by John Brown in Great Britain for use in various parts of the world. Riley equipment will now be made in both the United States and Great Britain in accordance with designs by Riley. The agreement also provides for a continuing interchange of engineering information and data on performance in connection with the utilization of all types of fuel and the generation of steam in large boiler units operating at high pressure and temperatures.

New General Electric gas turbine powered locomotive for the Union Pacific Railroad. It develops 4500 hp which is the equivalent of a three-unit diesel-electric hog. Its maximum speed is approximately 65 mph

★ ★ ★

Methods of preventing explosion hazards in hospitals were demonstrated by Paul G. Guest, electrical engineer of the United States Bureau of Mines at the Winter General Meeting of the AIEE. This demonstration was a part of a session promoting electrical safety in hospitals and was sponsored by the Safety Committee of the Institute, of which Hendley Blackmon, Westinghouse Electric Corp., is chairman. Mr. Guest is head of the Instruments Section, Explosives and Physical Sciences Division, Bureau of Mines.

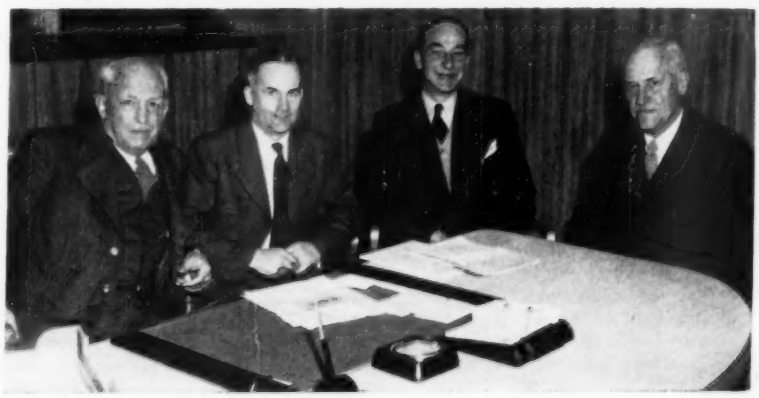
To show that static creates dangerous hazards in operating rooms and ways in which to overcome it, specially designed laboratory apparatus was used.

★ ★ ★

Fairless Works of United States Steel will soon be producing 235,000 tons of hot rolled sheets, 289,000 tons of bar products, and 280,000 tons of small diameter pipe. On December 11, 1952 the mill was officially started up.

Less than two years were taken to build this mill from scratch. More than 4,000 contractors and subcontractors located in 27 states and employing close to 3,000,000 people were engaged in the construction and tooling of Fairless Works. Nearly 10,000 construction workers were employed on the site during the peak period last year. The mill was erected on 3900 acres of former farm lands in the bend of the Delaware River south of Trenton, N. J., and has 75 miles of standard railroad track, 20 miles of improved roads, 30 miles of sewer, a water treating plant which will handle 254,000,000 gallons of water daily, and several miles of belt conveyors. Besides two blast furnaces and nine open hearths, it has two batteries of 87 coke ovens each.

L to R: L. E. Griffith, Pres., Riley Stoker Corp.; Eric Mensforth, Director, John Brown and Co., Ltd.; William V. Wright, Mgr., Land Boiler Division of John Brown and Co., Ltd.; F. H. Daniels, Chairman, Riley Stoker Corp.



★ ★ ★

Underway at the South Philadelphia Works of the Westinghouse Electric Corp. is a $32,000,000-expansion program that will take about a year to complete.

The project involves re-occupancy, under lease agreement, of the Navy-owned Merchant Marine plant adjoining the South Philadelphia Works, extensions to existing buildings, extensive purchases of new machine tools, and a previously announced $6,000,000 steam and gas turbine research and development laboratory. (See Power Engineering, October 1952, page 108).

The current program will materially increase production of marine propulsion units of all sizes and electric utility turbines in sizes from 10,000 to 250,000. Equally important, it will provide needed manufacturing facilities to increase production of gas turbines, now being used in greater numbers as prime movers for power generators, to drive locomotives, and to pump gas through the nation's pipelines.

★ ★ ★

Gilbert K. Hardacre, manager of sales promotion, Commonwealth Edison Company, has been re-elected president of the Chicago Lighting Institute.

Darwin Curtis, Chairman of the Board of Curtis Lighting, Inc., was elected vice-president; M. W. Ross of Commonwealth Edison Company was elected secretary-treasurer; and Carl W. Zersen was re-elected assistant secretary-treasurer.

Arthur Larson of Commonwealth Edi-

son Company was appointed chairman of the technical committee; Glenn M. Boyd of the Public Service Company of Northern Illinois as chairman of the committee on management, and Carl F. Jensen of the Westinghouse Electric Lamp Company, as chairman of the committee on lighting education.

★ ★ ★

Dr. John C. Warner, President of Carnegie Institute of Technology, announced a grant of $30,000 has been received from the Ford Foundation and will finance an inventory of knowledge in the field of human behavior in business and other organizations. The study will investigate what is now known about the way people behave as parts of going organizations, and will attempt to point out gaps in knowledge that need to be filled for more effective planning and operations in such organizations.

The project at Carnegie's will be directed by Dr. Herbert A. Simon, Professor of Administration in the graduate School of Industrial Administration.

★ ★ ★

Arthur H. Kuljian, Chief Mechanical Engineer for The Kuljian Corporation, Engineers and Constructors, Philadelphia, will be vice-president in charge of engineering, as announced by James L. Cherry, executive vice-president.

Mr. Kuljian has had wide experience in the design and engineering of steam electric power stations, industrial plants, boiler house extensions, and chemical plants, both in this country and abroad. Among the projects he has supervised are the Florida Power Corporation's Higgins Plant at Booth Plant, Florida, the Bokaro Thermal Power Plant in India, the Palermo Steam Power Plant at Palermo, Sicily, the Ford Motor Company's Number One Powerhouse at River Rouge, the Sun Oil Company's recent expansion at Marcus Hook, Pa., and the Army Air Force's new cantilever-type maintenance hangars.

Arthur H. Kuljian, vice president in charge of engineering, The Kuljian Corp., Philadelphia, Pa.

★ ★ ★

C. B. Campbell has been appointed consulting engineer, and J. R. Carlson manager of engineering for the Steam Division of the Westinghouse Electric Corporation.

Above, C. B. Campbell, now consulting engineer and below, J. R. Carlson, manager of engineering, Steam Division of Westinghouse Electric Corp.

Mr. Campbell joined Westinghouse in 1919 as a technical apprentice following his graduation from the University of Michigan. Since 1921 he has held various supervisory positions in the division's engineering department. He has been manager of engineering since 1944.

Mr. Carlson joined the Company as a technical apprentice following his graduation from the University of Nebraska in 1926. He was connected with the steam sales department from 1928 until 1941, when he was transferred to the engineering department. He has served as manager of the division's general engineering section since 1947.

★ ★ ★

A. W. McKinney, The National Supply Co., president of the Diesel Engine Manufacturers Assoc.

A. W. McKinney, executive vice president of The National Supply Company, has been elected president of the Diesel Engine Manufacturers Association.

Mr. McKinney joined The National Supply Company, manufacturer and distributor of engines, oil field machinery and equipment, and pipe, in 1920 shortly after his discharge from the U. S. Army. He rose through various positions to his present office in the company, to which he was elected in 1948.

★ ★ ★

Recognizing the grave shortage of engineering students in the United States and the urgent importance of metals research to the security of the free world, the 22,000 members of the American Society for Metals have voted unanimously to transfer an initial $650,000 for the establishment of a Foundation for Education and Research.

Assets of the Foundation will provide a yearly income to be used for the advancement and dissemination of scientific knowledge, especially relating to metals. Full information about the program can be obtained from William H. Eisenman, National Secretary, American Society for Metals, 7301 Euclid Avenue, Cleveland 3, Ohio.

★ ★ ★

Nelson S. Hibshman, dean of the School of Engineering, Pratt Institute, Brooklyn, has been appointed assistant secretary of the American Institute of Electrical Engineers.

It is expected that Dean Hibshman, who is treasurer of the Institute, will succeed Mr. Henline upon the latter's retirement in the Spring of 1954.

Walter J. Barrett, of Glen Ridge, N. J., will succeed Dean Hibshman as treasurer, and L. F. Hickernell, of Dobbs Ferry, N. Y., will replace Mr. Barrett on the Board of Directors to fill out his term ending July 31, 1954.

LEADING MANUFACTURERS HAVE HELPED "JOB PROVE" SUN TRANSFORMER OILS

Over the years, leading manufacturers of transformers have helped us "Job Prove" Sun Transformer Oils. They have found, through continuous use, that these Sun oils have the excellent heat-transfer characteristics needed to meet the requirements of today's transformers. In addition, they are highly stable and resistant to oxidation, completely dependable in protecting equipment and reducing maintenance and replacement.

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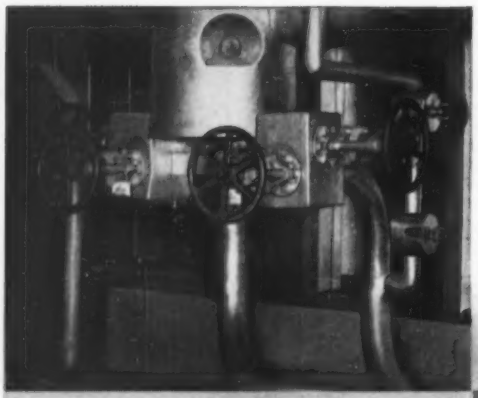
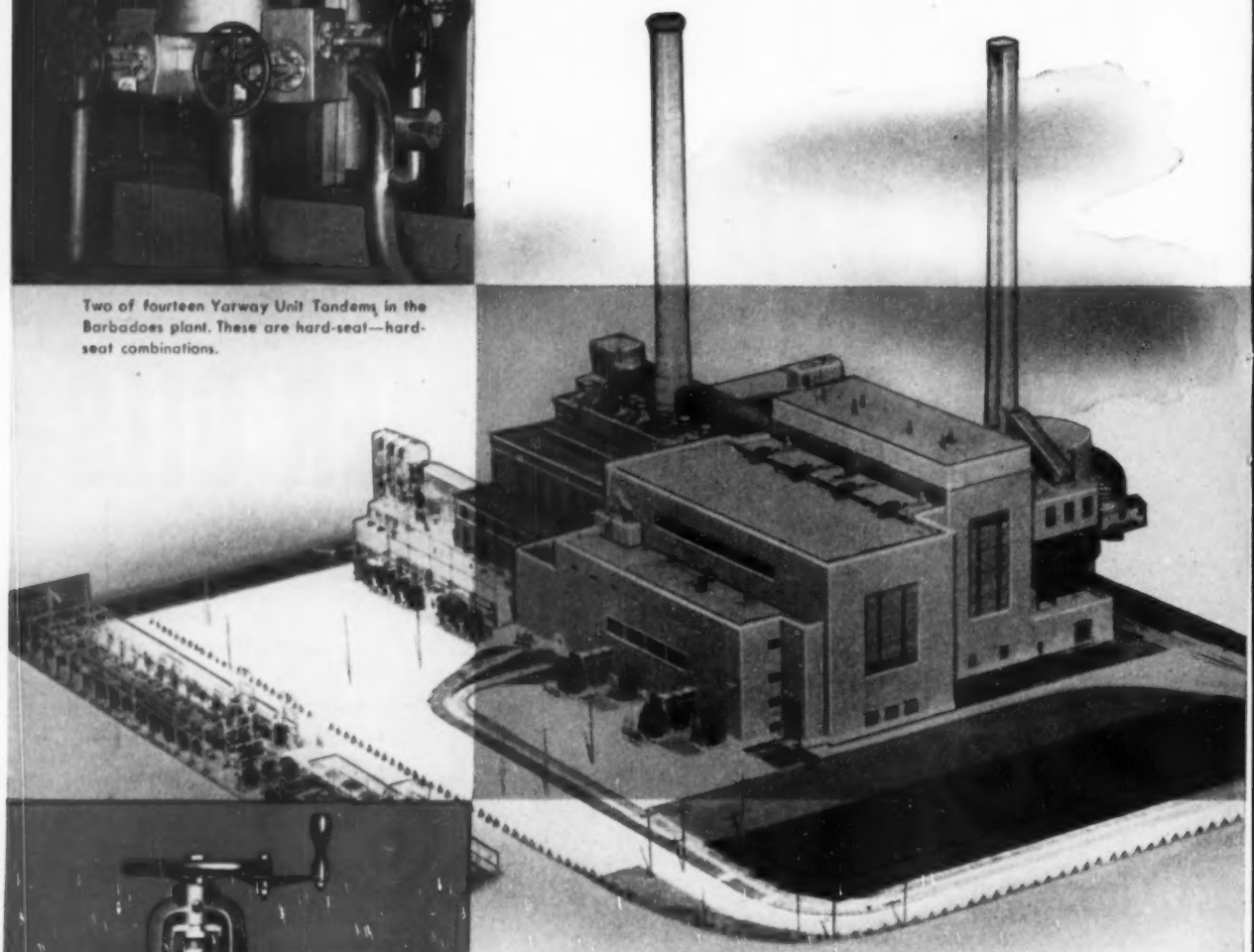
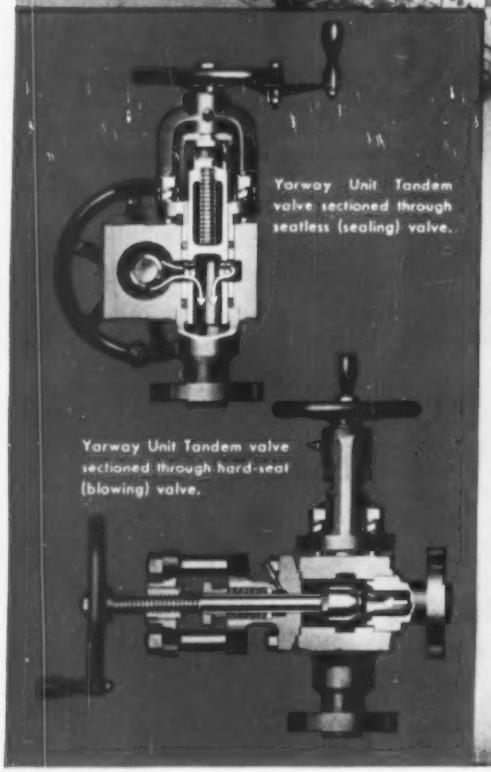
BARBADOES BOILERS GET



Two of fourteen Yarway Unit Tandems in the Barbadoes plant. These are hard-seat—hard-seat combinations.





Yarway Unit Tandem valve sectioned through seatless (sealing) valve.

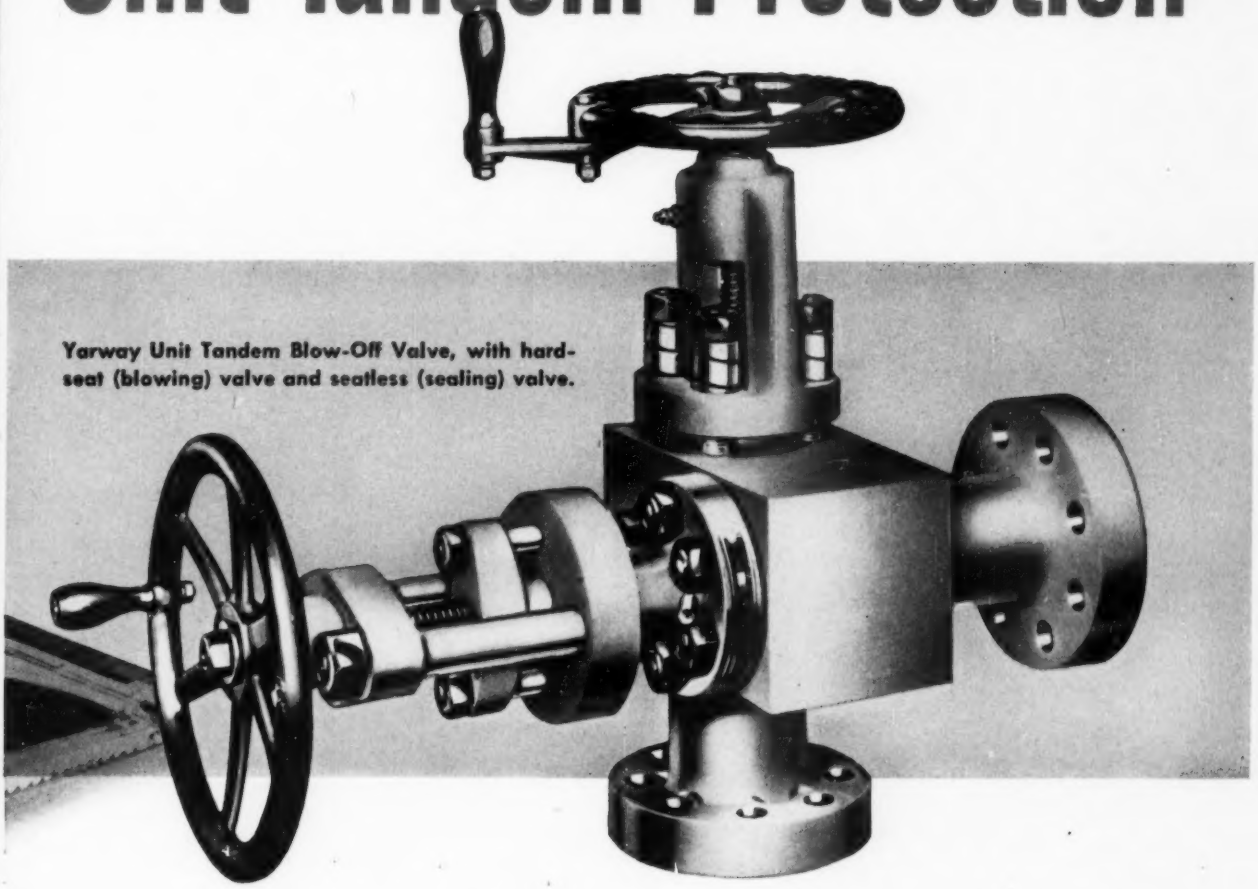
Yarway Unit Tandem valve sectioned through hard-seat (blowing) valve.

■ When a company has a $25,000,000.00 stake in the future such as Philadelphia Electric Company does in its Barbadoes Station —then protects the boilers of that plant with Yarway Unit Tandem Blow-Off Valves—it's significant of the dependability of those valves.

Barbadoes is a fine example of modern power plant engineering, demonstrated by the fact that only 11 men per shift are needed for operating this 180,000 KW station.

YARWAY

Unit Tandem Protection



Yarway Unit Tandem Blow-Off Valve, with hard-seat (blowing) valve and seatless (sealing) valve.

Yarway Unit Tandem Blow-Off Valves also are a good example of steam equipment engineering—used in more than 4 out of 5 high pressure boiler plants in the country.

Rugged construction makes Yarways strong and tough enough to withstand severest blow-down conditions. Metallurgical improvements make them resistant to the reactions of periodic acid wash. *Outages are rare where Yarway boiler valves are used.*

Unit tandems are available in various combinations to meet all pressure and service requirements.

Write for Bulletin B-433 for full details on Yarway Unit Tandems. For lower pressure blow-off valves, write for Bulletin B-424.

YARNALL-WARING COMPANY
114 Mermaid Avenue, Philadelphia 18, Pa.
BRANCH OFFICES IN PRINCIPAL CITIES

STEAM PLANT EQUIPMENT

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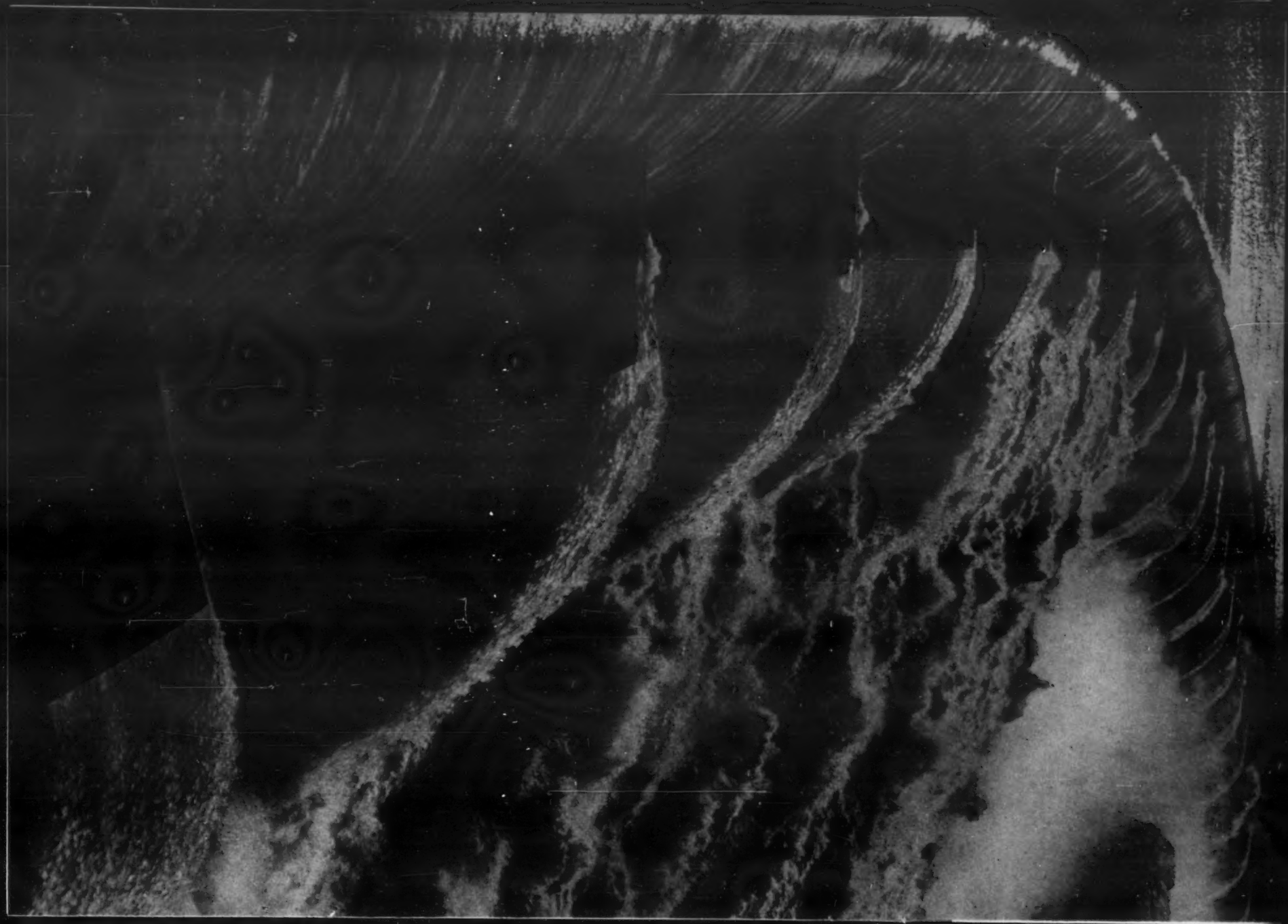

cochrane
water conditioning

STARTS WHERE NATURE STOPS

Nature's purest water will not meet the stringent requirements of modern industrial processing. The presence of minerals, salts or gases makes it unsuitable or uneconomical for direct use. Profitable elimination of corrosive or process retarding elements requires specialized experience such as furnished by Cochrane Water Engineers.

Engineering wisdom dictates that it is not so important to know all the answers as to know where to get them. The problems of Ion Exchange, Demineralization, Deaeration, Dealkalization, and others are complex; and there is only one *best* solution to any set of conditions. That's why leading engineers and consultants call on Cochrane for the answers.

To any water conditioning problem Cochrane contributes 89 years of accumulated "know-how". Whether your requirements are for process water or boiler feedwater, Cochrane can show you how to obtain them—economically and efficiently. And since Cochrane manufactures all types of water conditioning equipment, you are assured unbiased recommendations.

When you have a water conditioning problem call on Cochrane. Your requirements will be thoroughly surveyed by a Cochrane Water Engineer . . . then you'll know you're right. To give you prompt consultation and service, Cochrane Water Engineers are strategically located in 29 cities throughout the United States. Write today for the address of our office nearest you.

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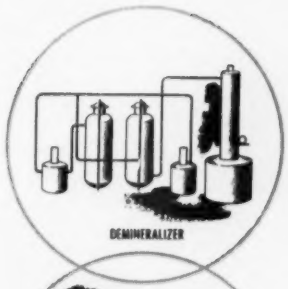
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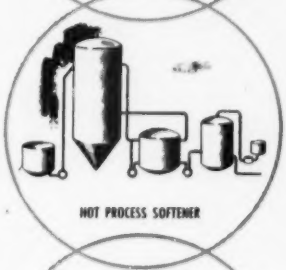
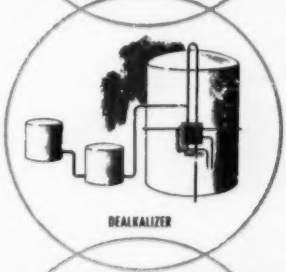
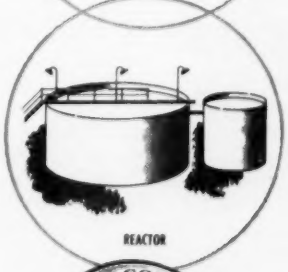

HOT PROCESS SOFTENER


DEALKALIZER


REACTOR

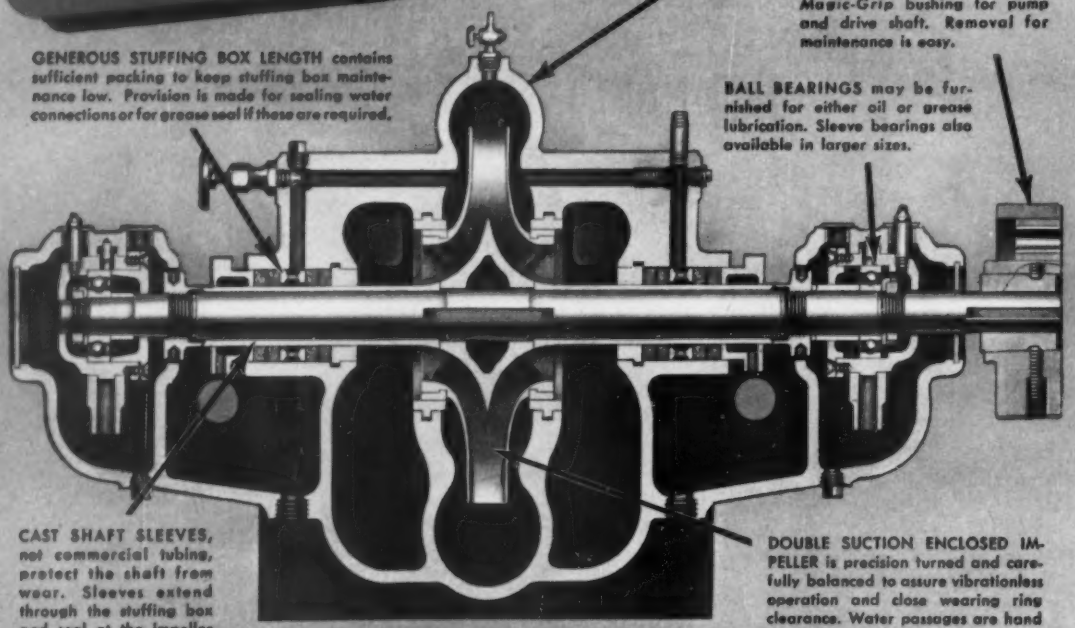
cochrane
corp. 3123 N. 17TH STREET, PHILADELPHIA 32, PA.

In Canada: Canadian General Electric Co., Ltd., Toronto
In Mexico: Babcock & Wilcox de Mexico, S.A., Mexico City
In Europe: Recuperation Thermique & Epuration, Paris

For more data circle 506 on Post Card

ALLIS-CHALMERS

Double Suction PUMPS


STANDARD AND SPECIAL MATERIALS available for many types of service where government regulations permit. Iron, bronze, stainless steel and combinations of these materials handle both alkaline and acid solutions.
HEAVY, HORIZONTAL SPLIT CAST IRON CASING construction with suction and discharge nozzles located in lower half for easy inspection without disturbing piping.
COUPLINGS are usually of the pin and rubber bushing type with Magic-Grip bushing for pump and drive shaft. Removal for maintenance is easy.
GENEROUS STUFFING BOX LENGTH contains sufficient packing to keep stuffing box maintenance low. Provision is made for sealing water connections or for grease seal if these are required.
BALL BEARINGS may be furnished for either oil or grease lubrication. Sleeve bearings also available in larger sizes.
CAST SHAFT SLEEVES, not commercial tubing, protect the shaft from wear. Sleeves extend through the stuffing box and seal at the impeller hub.
DOUBLE SUCTION ENCLOSED IMPELLER is precision turned and carefully balanced to assure vibrationless operation and close wearing ring clearance. Water passages are hand finished to a smooth surface.

STANDARD SIZES carried in stock range from 10 to 7000 gpm with heads as high as 475 feet. Larger sizes are available.

Built for LONG LIFE

HEAVY DUTY CONSTRUCTION—no skimping, no corner cutting—is what you can look for in Allis-Chalmers Type S pumps. Extra metal thicknesses, extra strong parts, extra construction features, and extra careful workmanship are always there to give you long life, low maintenance and low cost per gallon pumped.

Every Allis-Chalmers double suction pump is carefully tested on the most modern pump testing equipment in the industry. Each installation is individually engineered by men whose experience in thousands of pump installations will give exactly the right pump for your needs.

Allis-Chalmers can take full responsibility for your pumping operation because Allis-Chalmers can furnish the complete installation — pump, motor, control and drive—all built of coordinated design by one manufacturer. Efficient operation is assured and maintenance costs are kept low.

Whatever your pumping problem, call your nearby Allis-Chalmers Authorized Dealer or District Office. Or write to Allis-Chalmers, Milwaukee 1, Wisconsin, for Bulletin 08B6146. A-3580

Texrope, Vari-Pitch and Magic-Grip are Allis-Chalmers trademarks.

Sold . . .

Applied . . .

Serviced . . .

by Allis-Chalmers Authorized Dealers, Certified Service Shops and Sales Offices throughout the country.

MOTORS — ½ to 25,000 hp and up. All types.

CONTROL — Manual, magnetic and combination starters; push button stations and components for complete control systems.

TEXROPE — Belts in all sizes and sections, standard and *Vari-Pitch* sheaves, speed changers.

FREE slide films on pump theory, application and maintenance. Ask your Allis-Chalmers representative.

ALLIS-CHALMERS

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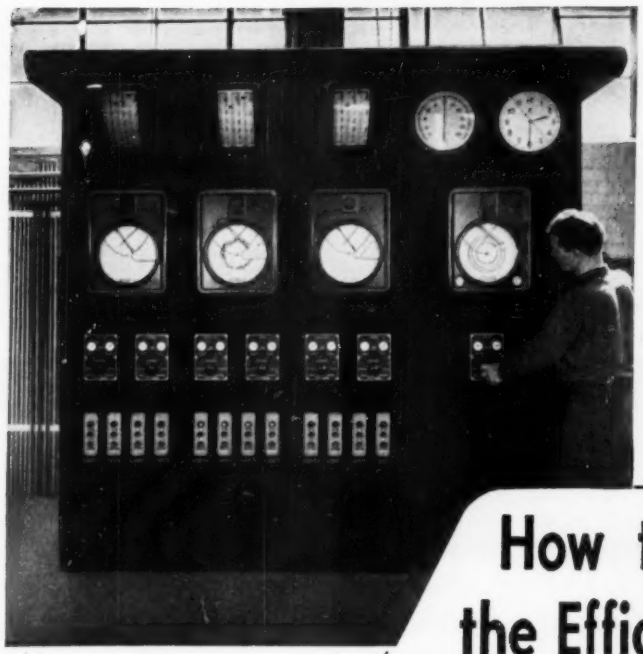


These Bailey Boiler Controls at the Chicago Pneumatic Tool Company's new plant in Utica, N. Y. insure efficient operation of three 25,000 lb per hour, 100 psi, spreader stoker-fired boilers

How to INCREASE the Efficiency of YOUR BOILER-ROOM DOLLAR

Before you get steam you've got to spend dollars—so dollars are a form of energy.

And if your boiler-room dollars are invested in equipment that isn't working efficiently, economically, your "investment" is poor.

That's where co-ordinated controls by Bailey can help. Here's why they'll increase your "boiler-room investment efficiency":

1. Complete Range of Equipment—fully co-ordinated. You need never worry that a Bailey Engineer's recommendation is slanted in favor of a particular type of equipment, just because he has a limited line to sell—or that Bailey will pass the buck for efficient control; we offer *complete* boiler control systems.

2. Engineering Service—backed by experience. No other manufacturer of instruments and controls can offer as broad an experience, based on successful installations involving all types of combustion, flow measurement and automatic control.

3. Direct Sales-Service — conveniently located near you. Bailey Meter Company's sales-service engineers are located in more industrial centers than those of any other manufacturer of boiler control systems; you get prompt, experienced service with a minimum of travel time and expense.

•

For better "boiler-room investment" efficiency —for more power per fuel dollar, less outage and safer working conditions, you owe it to yourself to investigate Bailey Controls. Ask a Bailey engineer to arrange a visit to a nearby Bailey installation. We're proud to stand on our record: "More power to you!"

A-111-0

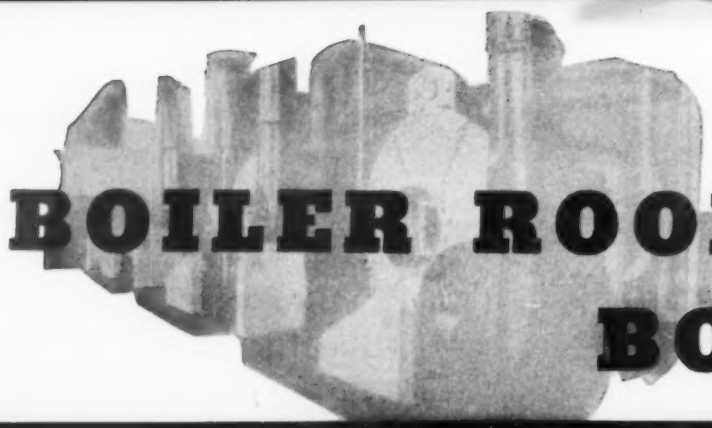
BAILEY METERS

BAILEY METER COMPANY

1040 IVANHOE ROAD
CLEVELAND 10, OHIO

Controls for Steam Plants
COMBUSTION · FEED WATER
TEMPERATURE · PRESSURE
LIQUID LEVEL · FEED PUMPS

For more data circle 508 on Post Card



THE BOILER ROOM BOTH STEAM COSTS

Operating men figure their costs in pounds of steam, management figures the cost in dollars, but the records of both will always prove — *you pay less for steam when you use Preferred!*

Today's up-to-date operating engineers want facts, figures, and sound engineering, all combined to give them maximum thermal efficiency at minimum costs. These men know the need for scientific downdraft gas travel, the importance of precision firing over a wide load range and how important it is that their equipment burn, *efficiently, all types of gas and oils,* regardless of viscosity, temperature or grade—and that's why you'll find more and more operating engineers saying "Preferred steam costs us less!"

Their Records Agree

From carefully-kept records, management has learned that there *is* a difference in steam-generating equipment. They ***know*** how much installation costs they save on Preferred's Unit Steam Generator that needs no stack, no special foundation or extra, high head room. They've learned, from actual experience, how *dependable* it is and how definitely positive the savings they make when their Preferred records show, year after year, *an actual thermal efficiency of 80%!*

Custom-Built To Job Specification and available in a wide range of sizes from 20 to 600 BHP, Preferred's Unit Steam Generators are fired by light or heavy oil, natural or manufactured gas, alone or in combination. Shipped *completely shop assembled,* tested, run in and ready for service lines hook-up, the Preferred Unit Steam Generator's fast becoming industry's first choice when it comes to a dependable, completely packaged heat and power unit.

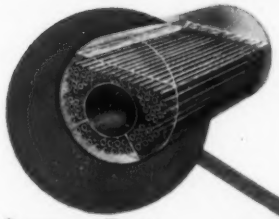
ONLY PREFERRED CAN OFFER YOU ALL THESE FEATURES

1. *5 Square Feet of Heating Surface* per boiler horse power. Heat transfer surface commensurate with long life and high efficiency.
2. *Four Pass Gas Travel* assures uniform distribution of generated heat. Clean heat transfer surfaces to minimize tube cleaning and lower stack temperature.
3. *Down Draft Design.* High, guaranteed operating efficiency, plus low off-period losses. reduces over-all operating costs.
4. *Induced Draft.* Smoother starting, higher combustion efficiency, less refractory upkeep, eliminates poisonous fumes in boiler room.
5. *Intermediate Furnace Position.* Protects tube areas, safeguards shell from unequal heat distribution.
6. *Expansile Precipitator.* Clean, smokeless operation. Maximum gas velocities maintained equally in *all* tubes of pressure vessel.
7. *Staggered Tubes.* Thorough wiping of entire tube surfaces during maximum or minimum operation. Faster heat pick-up rate.
8. *Anti-Stress Deck.* Keeps sections of rear tube sheet—above and below water line—in close balance. Prevents unequal stress action within tube area.
9. *Dual Purging Action.* An important safety factor. Entire vessel is purged of gas vapors before *and* after firing.
10. Horizontal Rotary Oil Burner, Starts, ignites, follows load, shuts off, cleans and purges itself *automatically.*

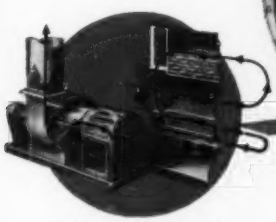
Remember **THERE IS A DIFFERENCE!**

AND THE **BOARD ROOM AGREE**

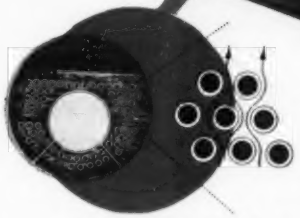
YOU LESS *with* PREFERRED



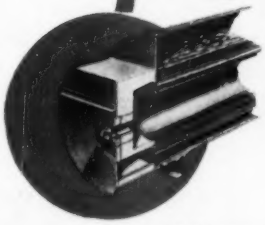
Five Square Feet



Induced Draft



Staggered Tubes



Anti-Stress Deck

PREFERRED UTILITIES Rigged for Results ENGINEERED

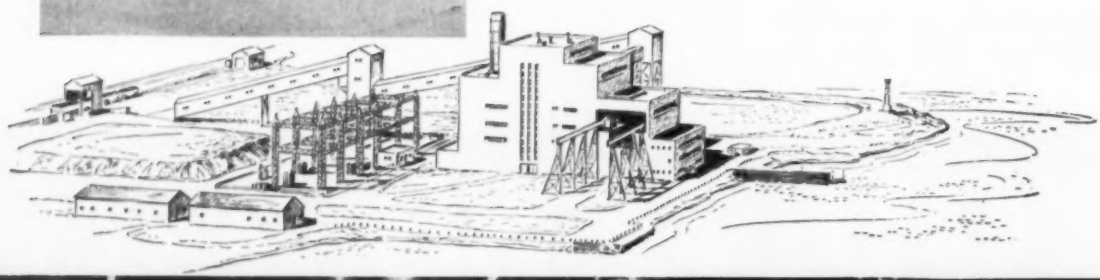
PREFERRED UTILITIES MANUFACTURING CORP.
1860 BROADWAY NEW YORK 23, N.Y.

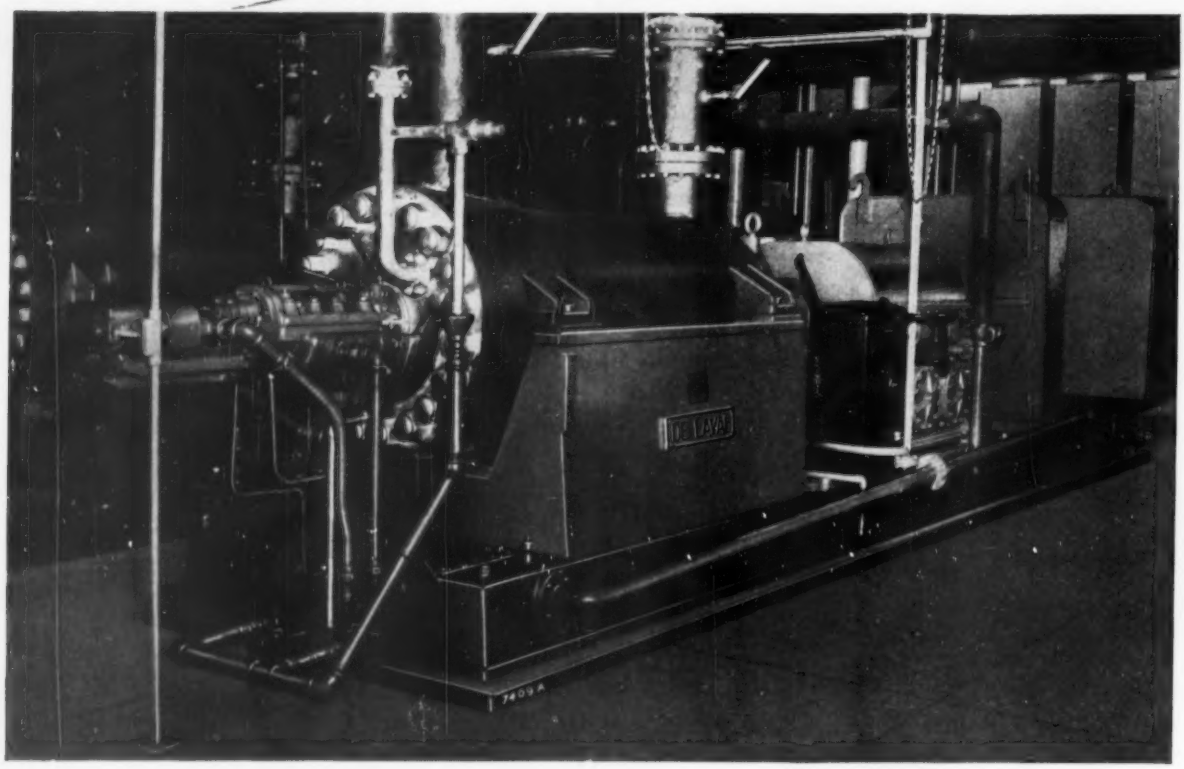
For more data circle 509 on Post Card

DE LAVAL

BARREL TYPE BOILER FEED PUMPS

on the job at Danskammer Point





These two De Laval 11-stage barrel type boiler feed pumps are now helping to produce power for the Danskammer Point Steam Station of the Central Hudson Gas and Electric Corporation. Both pumps, one of which is used for standby service, are sized for full boiler load and will deliver 1,400 gpm of 326F water against 2,155 psig discharge pressure. Two more same size De Laval pumps have already been ordered for the second main unit of the Danskammer Station.

De Laval barrel type boiler feed pumps meet all the requirements of high pressure boiler feed service. They can be thrown on the line quickly without long preliminary warming up. They are not affected by sudden temperature changes. The distinctive De Laval design assures years of reliable service with minimum maintenance.

DE LAVAL *Boiler Feed Pumps*

DE LAVAL STEAM TURBINE COMPANY

816 Nottingham Way, Trenton 2, New Jersey

DL 178

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LADISH

Controlled Quality

PIPE FITTINGS

offer dependability safeguarded by advanced metallurgy

Year after year . . . in all kinds of service . . . Ladish Controlled Quality Fittings set new standards of reliability. One reason is the strong reliance on technical progress. Every new facility and advanced technique of modern metallurgy is fully utilized to develop desirable physical properties to maximum limits . . . while unrelenting test procedures continuously safeguard metallurgical soundness and provide users with authentic data proving the complete dependability of every Ladish Fitting.

L

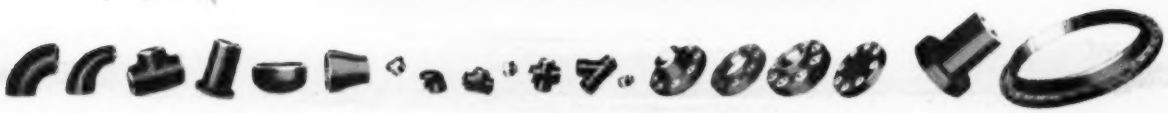
TO MARK PROGRESS

THE COMPLETE *Controlled Quality* FITTINGS LINE
PRODUCED UNDER ONE ROOF . . . ONE RESPONSIBILITY

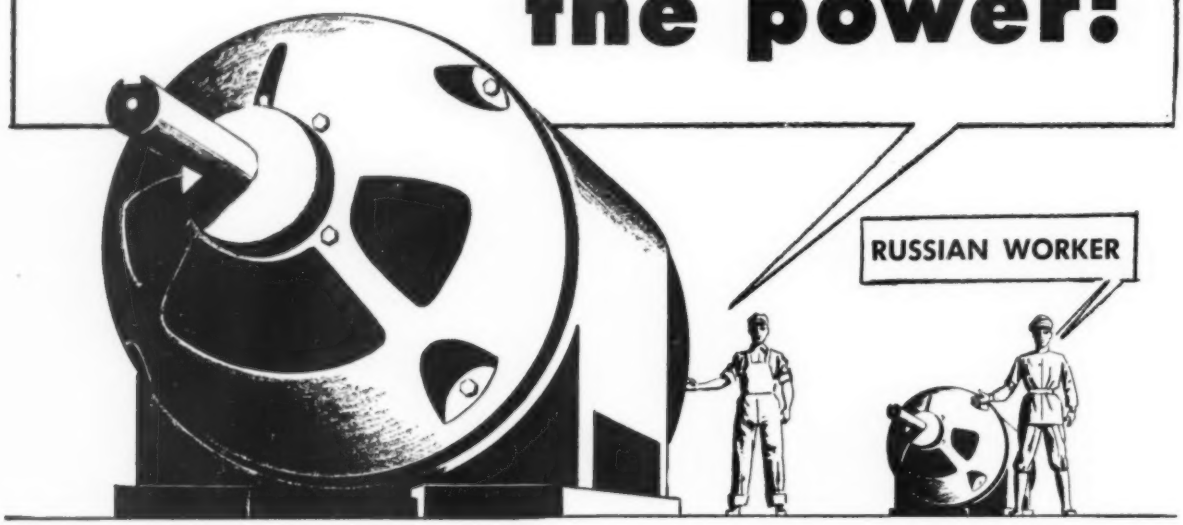
LADISH CO.

CUDAHY, WISCONSIN
MILWAUKEE SUBURB

District Offices: New York • Buffalo • Pittsburgh • Philadelphia • Cleveland • Chicago • St. Paul
St. Louis • Atlanta • Houston • Tulsa • Los Angeles • San Francisco • Havana • Mexico City • Brantford, Ont.



AMERICAN WORKERS HAVE 7 times the power!



How does America do it?

Why does the American worker have the help of about 7 times as many kilowatt-hours of electric power as is available to the Russian worker?

How can we Americans produce over 40% of the world's goods and bring so much more of everything to everybody with less than 6% of the world's population? Why is the American output per-man-hour still growing faster and faster?

The answers cannot be laughed off nor are they hard to find. In the words of Ralph J. Cordiner, president of the General Electric Company: "The greatest impetus for forward movement still comes when individuals are free to plan and carry out their own ideas without government coercion or unnecessary regulation."

Including estimated expenditures in 1952, private industry in the last seven years will have invested over 150 billion dollars in new plant and equipment. This contrasts with Federal Government investment of not much more than 12 billion for similar purposes in the same period. Moreover most such Government expenses during the last three years have been allocated to military and atomic projects.

Back of all this progress in private industry is the unique American system of competition—our kind of competition that continually stimulates Americans to make things better and to sell them better—and at lower prices.

In America we do not just compete for public office; we also compete in technology, competency of management, individual initiative and distribution—the latter including selling and advertising in all their varied forms.

Our kind of competition promotes the growth of more and more businesses and industries—and this means more jobs and expanding prosperity from which we all benefit.

"Planned economies" and other fancy theories are not for us. The American competitive system has given us the highest standard of living in the world. Let's all work to preserve it.

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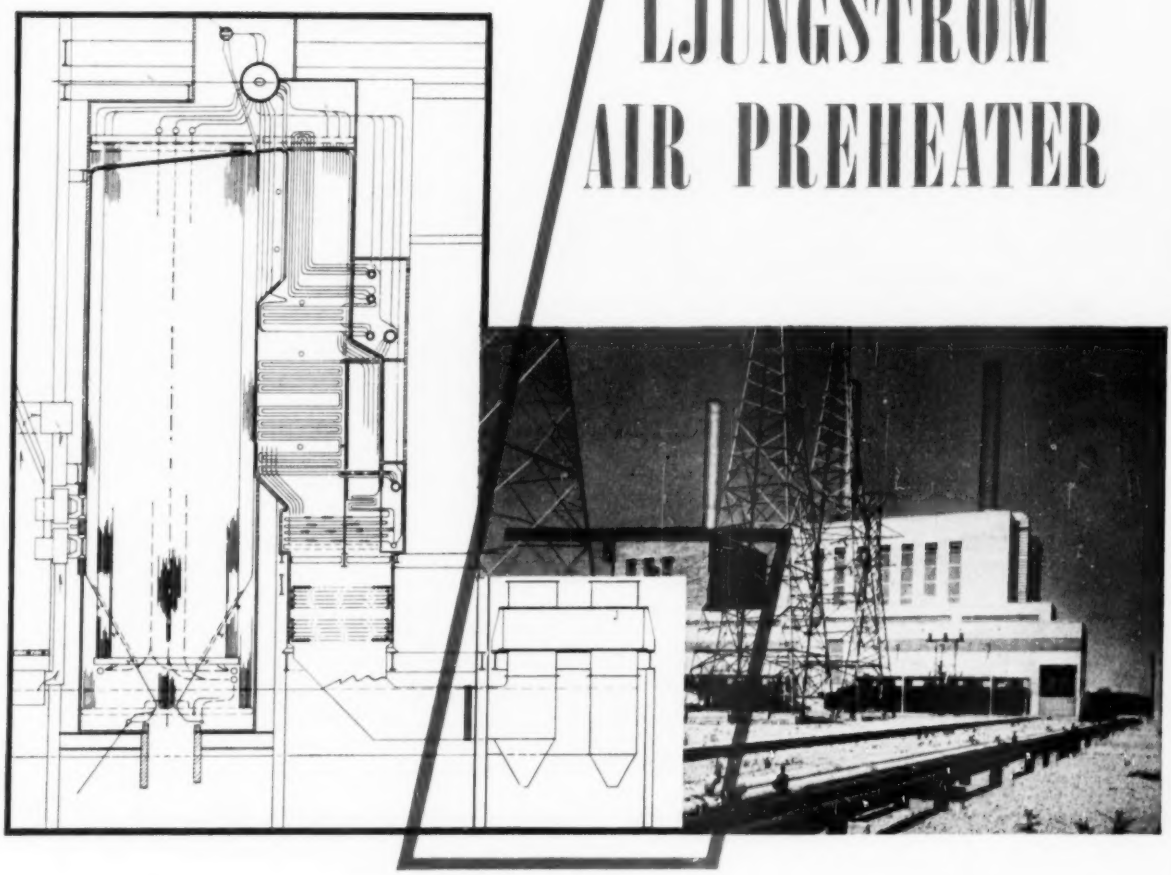
THE COMPETITIVE SYSTEM DELIVERS THE MOST TO THE GREATEST NUMBER OF PEOPLE

Million Pound Boiler at Sunbury Station of the Pennsylvania Power & Light Company

equipped with

LJUNGSTROM AIR PREHEATER



The latest addition to the Pennsylvania Power & Light Company's new Sunbury Station is a unit that adds 125,000 kilowatts to this utility's power output and increases the Station's capacity to over 400,000 kilowatts. The station was designed by Ebasco Services, Inc. under the utility's supervision, and built by the latter.

The reheat boiler for this unit was furnished by Foster Wheeler Corporation. It is fired by pulverized coal and has a capacity of 1,000,000 pounds of steam per hour at 1525 psi and 1005 F., reheated to 1005 F.

This Foster Wheeler boiler incorporates a Ljungstrom Air Preheater, which preheats combustion air to 543 F., and cools exit gas to 281 F.

Since the war, the total capacity of steam generating units equipped with Ljungstrom Air Preheaters – installed, under construction or on order in industrial and utility plants throughout the country – comes to well over 285,000,000 pounds of steam per hour. Every boiler manufacturer has included Ljungstrom Air Preheaters in prominent installations made during this period.

Air Preheater Corporation

60 East 42nd St., New York 17, N. Y.

For more data circle 512 on Post Card

For LOW-COST UPJOHN burns COAL

UPJOHN'S new pharmaceutical plant which includes units for production of penicillin and cortisone, as well as some 700 other pharmaceutical products, relies on coal for dependable steam.

This ultramodern boiler house supplies steam, cleanly and efficiently, at only 40¢ to 42¢ per 1,000 lbs. It delivers 115,000 lbs. per hour at peak load for the Portage Road Plant near Kalamazoo, Michigan.

There are no dust or smoke nuisances, thanks to the dust collecting and cinder re-injection system.

For both efficiency of operation and economy, you just can't beat coal burned the modern way!

If you operate a steam plant, you can't afford to ignore these facts!

COAL in most places is today's lowest-cost fuel.

COAL resources in America are adequate for all needs—*for hundreds of years to come.*

COAL production in the U.S.A. is highly mechanized and by far the most efficient in the world.

COAL prices will therefore remain the most stable of all fuels.

COAL is the safest fuel to store and use.

COAL is the fuel that industry counts on more and more—for with modern combustion and handling equipment, the inherent advantages of well-prepared coal net even bigger savings.

FOR HIGH EFFICIENCY
FOR LOW COST

DEPENDABLE steam, the modern way!

CLEAN, CONVENIENT!

This view of Upjohn's firing aisle shows how clean and convenient coal can be when handled and burned the modern way. The stoker hoppers are fed from an overhead bunker. A 2-ton capacity weigh larry serves all boilers.

The ash handling is fully automatic. Traveling grates continually discharge ashes into hoppers below the floor of the firing aisle.

The 3 boilers shown, plus a fourth recently installed (not illustrated), supply all Upjohn's steam needs.

• Whether you're building a new plant or modernizing an older one, you can count on coal for dependability and low-cost operation.

Here's why: Up-to-date coal-burning equipment can give you 10% to 40% more steam per dollar. Automatic coal- and ash-handling systems can cut your labor cost to a minimum. Let a consulting engineer show you how a modern coal installation, tailored for your specific needs, can save you real money.

Here's something else, too—of all fuels, coal alone has virtually inexhaustible resources. This, plus the fact that America's coal industry is the most efficient in the world, assures you of a dependable supply of coal at relatively stable prices now and for years to come.

BITUMINOUS COAL INSTITUTE
A DEPARTMENT OF NATIONAL COAL ASSOCIATION
WASHINGTON, D. C.

YOU CAN COUNT ON COAL!

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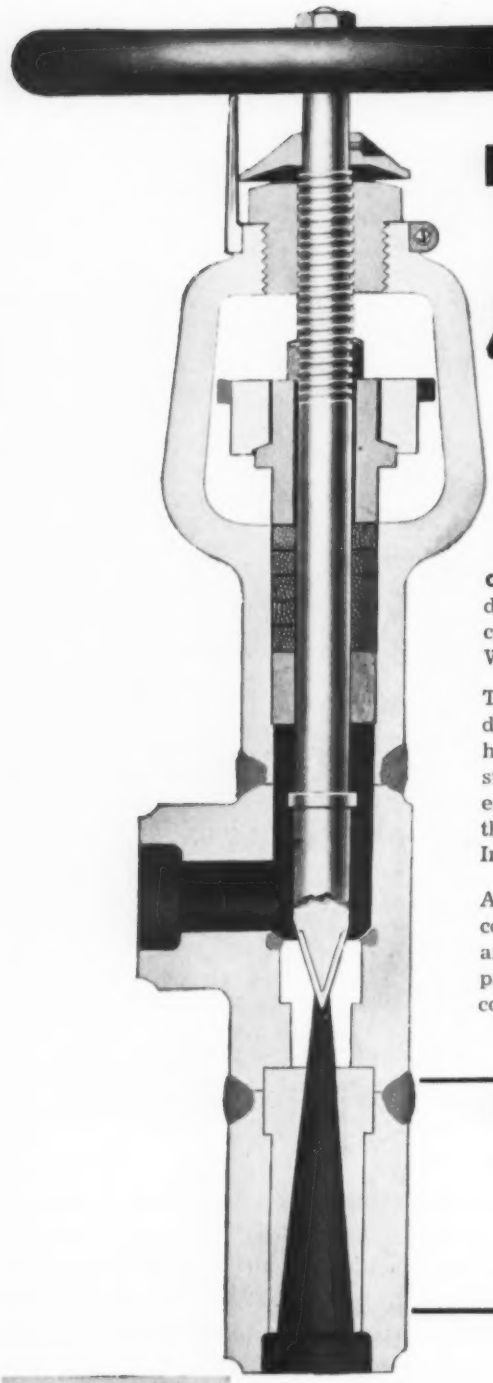

BUILT TO WITHSTAND *Flashing Steam...*

HANCOCK
HI-PRESSURE DROP
WELDVALVES

CONTINUOUS BLOWDOWN can wreck a conventional valve seat in a few days or weeks, regardless of pressure or temperature. Avoid the high cost of such quick destruction — specify Hancock Hi-Pressure Drop Weldvalves. They combine orifice, shut-off and index in a single unit.

The inlet of these blowdown valves is above the seat. The diverging delivery tube provides a rim for the flashing steam and compels the high-velocity stream of water to dissipate its force upon itself, instead of destroying the valve. This ingenious design assures long, economical life in continuous blowdown service. Because they are of the orifice type, you can use a smaller size valve with a large capacity. Intermediate capacities obtainable by adjusting the valve opening.

Ask for complete data on Hancock Hi-Pressure Drop Weldvalves for continuous blowdown systems. Also learn how these rugged valves are used on feed water pump bypass relief, in turbine washing processes, and in other services where corrosion is severe and conventional valves wear rapidly. Write or phone today.

HANCOCK HI-PRESSURE DROP WELDVALVES
NO BONNET JOINT DESIGN

Sizes: ¾", 1", 1½".
Orifice Sizes: Minimum ⅛" Maximum 1"
Pressures: 600 p.s.i. thru 2500 p.s.i.
Connections: Screwed or socket weld ends.
Seats: 500 Brinell Stainless Steel or Solid Stellite. Venturi throat silver brazed to the body.
Steam-Disc: Integral needle point—500 Brinell Stainless Steel or tipped with Stellite.

When Hancocks go in, valve costs go down.

HANCOCK VALVES

A product of **MANNING MAXWELL & MOORE, INC.** WATERTOWN 72, MASSACHUSETTS

MAKERS OF 'HANCOCK' VALVES, 'ASHCROFT' GAUGES, 'CONSOLIDATED' SAFETY AND RELIEF VALVES, 'AMERICAN' INDUSTRIAL INSTRUMENTS. BUILDERS OF "SHAW-BOX" CRANES, 'BUDGIT' AND 'LOAD LIFTER' HOISTS AND OTHER LIFTING SPECIALTIES.

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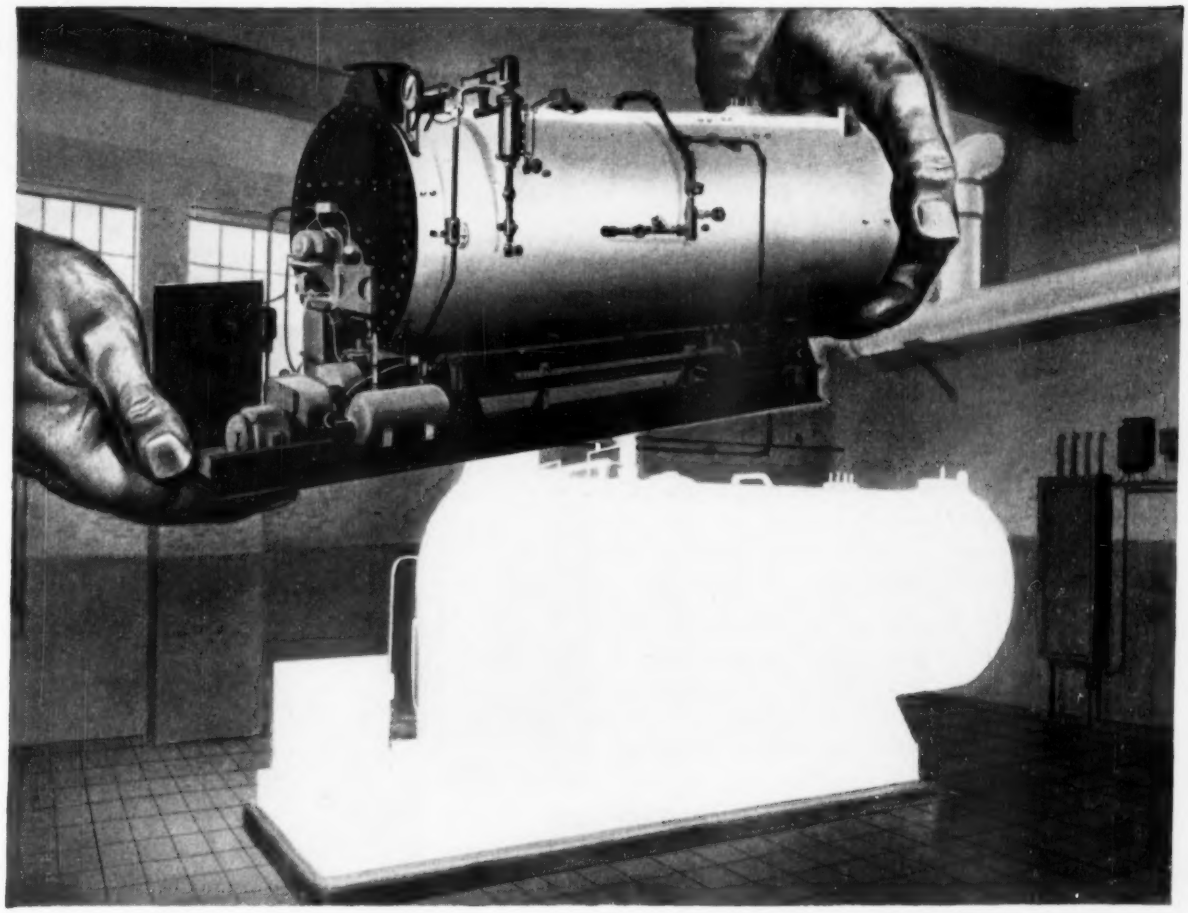
Ready when you need it...



Save Installation-Construction Time — Expedite Emergency Installations — Serve Immediate Temporary Steam Needs — With a Cleaver-Brooks Self-Contained Boiler

WHEN speed is vital, you can save weeks of valuable installation time with a Cleaver-Brooks boiler — delivered to location as a complete, factory assembled and tested, self-contained unit, with much of the trim and accessories provided.

In an emergency the installation time can be reduced to as little as 48 hours, by following a properly planned and coordinated procedure of providing in advance the required facilities — foundations, headers, service and blow-off lines, fuel tanks and lines.

Prior to the completion of your building, Cleaver-Brooks boilers can be placed in operation to serve immediate steam needs. When permanently installed the change-over takes place with a minimum of labor and expense and the avoidance of interrupted steam service.

Cleaver-Brooks are the first and finest in modern, self-contained boilers — operate at a guaranteed efficiency of 80% — burn the fuel most available and economical in your area, gas, oil, or combination gas and oil — fully meet all codes — standard models available in sizes 15 to 500 hp; 15 to 250 psi.

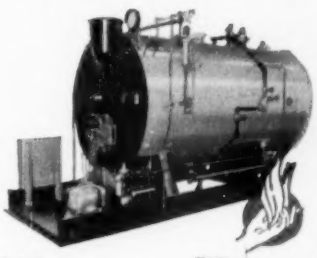
CLEAVER-BROOKS COMPANY
Originators of the Self-Contained Boiler
Dept.B -310 E. Keefe Ave., Milwaukee 12, Wis., U.S.A.
Cable Address: Clebro-Milwaukeewis

Write for latest, fully illustrated and descriptive Cleaver-Brooks Steam Boiler Catalog.

For more data circle 515 on Post Card

WHY INSTALLATION TIME IS CUT:

- Simple Low-Cost Stack
- No Job-Site Brickwork — No Special Foundations
- Boiler Delivered as a Complete, Factory Assembled, Tested, Self-Contained Unit
- Centralized Responsibility — No Waiting on Multiple Sources of Supply



Cleaver-Brooks

Builders of Equipment for the Generation and Utilization of Heat • Steam Boilers • Oil and Bitumen Tank-Car Heaters • Distillation Equipment • Oil and Gas-Fired Conversion Burners

valve values
PHOTO NEWS

MICROMEASURING...
Edward Dimensional Control In Action

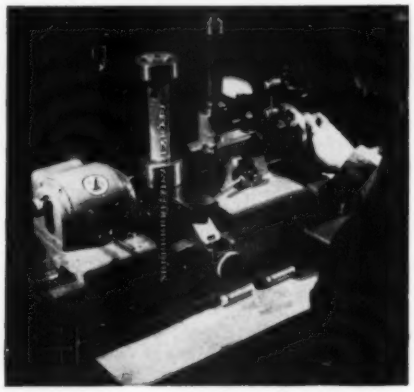
The young lady at right is operating the Micronoscope, a unique measuring device developed by Edward to check the all-important seat-disk joint on steel valves. Exclusive with Edward, this high vacuum inspection tool detects minute variations in surface finish and concentricity. If the joint is not vacuum-tight it is rejected!

Here at Edward we're well equipped with measuring devices of all types—and we use them often. For example, the components that make up each of the Fig. 7543 blow-off valves illustrated on the opposite page get 196 dimensional checks during manufacture. Regular inspections on all valves are performed at every manufacturing step by highly trained inspectors whose only responsibility is to double-check on the precision of our machines and men.

All this has a dollars and cents value for you. For this manufacturing accuracy, when added to Edward design and metallurgical leadership, results in valves that give long dependable service free from expensive shut-downs or high maintenance cost.

At Edward, the latest developments in optics, electronics, and other sciences are constantly searched for better methods of dimensional control. Above, optical contour projector magnifies image of stem for Fig. 952 instrument valve 62½ times, permits checking all tolerances to one ten-thousandth of an inch, all angles to one minute. Below, electrically operated Pratt & Whitney standards machine measuring accurately to within .000010 of an inch is used to check thread gage.

Electronic surface analysis test of stems for Fig. 4828 valves. Surface variations are measured in millionths of an inch, reproduced on chart in inspector's hand.



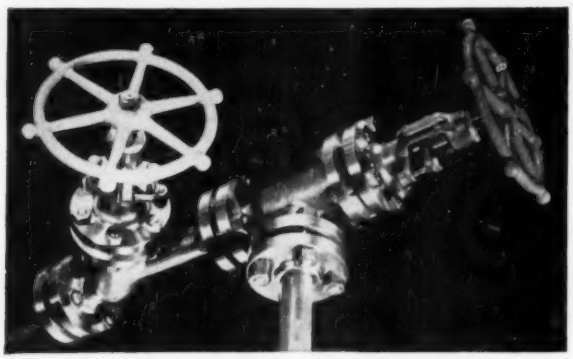
Edward Valves, Inc. Another Product

HOW TO SELECT AND OPERATE BLOW-OFF VALVES

A few special precautions in selecting and operating your blow-off valves will prolong their life, cut down on maintenance, and avoid trouble. For example:

1. Select two valves of identical design. This will permit interchangeability of parts.
2. During blow-down periods, first open the valve nearest the boiler wide, then slowly open the valve furthest from the boiler. In shutting down the valves, close the valve furthest from the boiler first, then close the valve nearest the boiler.

   This operating sequence places most of the wear on the valve furthest from the boiler and insures that a good tight valve is found nearest the boiler at all times. Should the valve furthest from the boiler, which is used as the blowing valve, show signs of excessive wear, seat erosion, etc., it can be removed from the line and repaired or replaced



without shutting down the boiler, while the valve nearest the boiler maintains boiler pressure.

3. Pick blow-off valves with the packing far removed from the high temperature zone. An extra feature in Edward valves is a positive backseat which seals off packing from the high temperature area.
4. Avoid gadgety-involved designs in selecting your blow-off valves. You're interested in long dependable service, not in trick construction.
5. The blowing valve should not be opened too quickly in order to avoid damaging shock to piping. Edward blow-off valves are of a special slow opening variety, and can be opened at normal speed, eliminating the possibility of error by inexperienced operators.

Many of your blow-off problems can be eliminated by selecting Edward valves, veterans of nearly fifty years of service in blow-off applications. With Edward you get a functionally simple design for greatest dependability. The use of identical valves permits maximum piping flexibility and interchangeability of parts. Disk is elevated from seat on operating instead of grinding against it, eliminating the possibility of seat-disk galling.

Provided in ASA pressure classes for 300, 600, 900 and 2500 lb, sizes 1½", 2", 2½"—straightway or angle, flanged or socket welding ends. Stellite or EValloy trim. Write for Catalog 12-D.

EDWARD VALVES, Inc., *Subsidiary of*
ROCKWELL MANUFACTURING COMPANY
220 W. 144th STREET • EAST CHICAGO, INDIANA

GLOBE AND ANGLE STOP • FEED-LINE • BLOW-OFF • NON-RETURN CHECK • GATE • GAGE AND INSTRUMENT • RELIEF • STRAINERS

Technical Tips

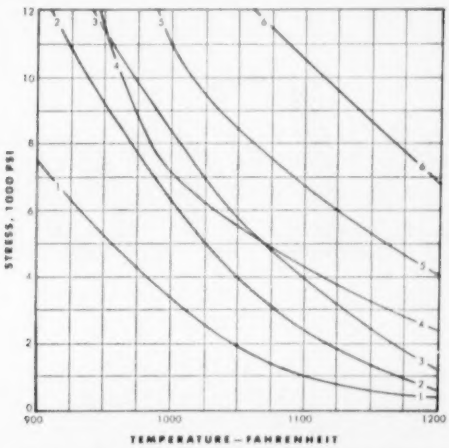
"Creep" Robs Metal Strength At High Temperatures

Steels stressed in a high temperature range show an unusual behavior—over a period of many days or years they may slowly stretch or bend out of shape. This phenomena is known as "creep". Some plastics do this at room temperature.

"Creep strength" rather than tensile strength limits the use of metals in valve design for high temperature use. This "creep strength", expressed in psi, refers to the load that can be carried by a metal without excessive plastic flow. The limiting plastic flow is most commonly considered as an increase in length of 1 per cent in 100,000 hours of time.

A single creep test must be run for 1,000 hours or more to measure this small rate of plastic flow. Each new type of metal to be investigated must be tested at several different loads to find the one which will most nearly cause plastic deformation at a rate of 1 per cent in 100,000 hours. Each set of tests must be repeated at several temperatures to cover the operating range in which the steel might be used. Hence, ten to twenty tests of 1,000 hours each are needed to find the creep strength of a single type of steel.

The creep strengths of six different steels often used in valve bodies for high temperature service are shown below.



CREEP STRENGTH VS TEMPERATURE

1. Low Carbon Steel
2. Carbon——0.50% Molybdenum Steel
3. 1.25% Chromium——0.50% Moly. Steel
4. 2.25% Chromium——1.00% Moly. Steel
5. 18% Chromium——8% Nickel Steel
6. 18% Chromium—8% Nickel—Mo. Steel

Creep testing in Edward laboratories.

Edward

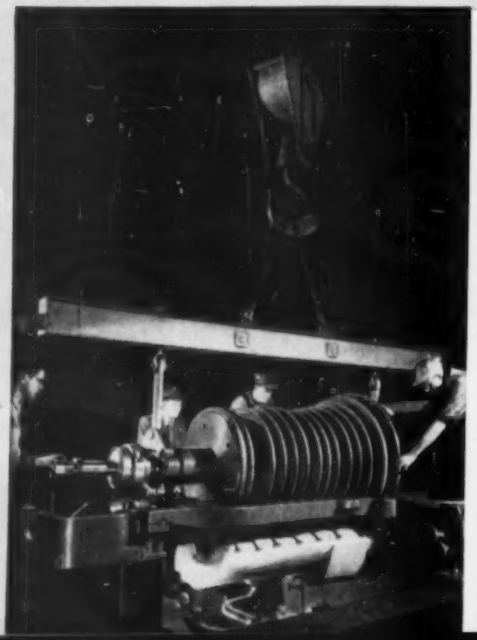
From Shop

HERE'S HOW Allis-Chalmers Builds the Generator Unit that's Easy to Install, Low in Foundation Cost

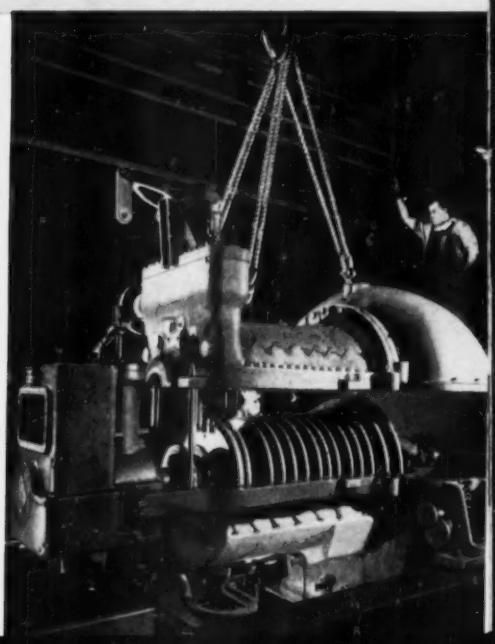
MODERN Allis-Chalmers WA-Series steam turbine generating units are factory tested and shipped with rotors locked in place to save you installation time. Oil piping and generator air coolers are both above the floor line to reduce your foundation costs.

WA-Series units are built in ratings from 2000 to 7500 kw for either condensing or non-condensing operation. For your copy of Bulletin 03B7654, call your nearest A-C office or write to Allis-Chalmers, Milwaukee 1, Wisconsin. A-3910

1 Precision balanced turbine rotor assembly being lowered into casing. All wheels have durable chrome alloy steel buckets.



2 Upper half casing of this compact impulse steam turbine is next added in the process of assembling the WA-Series unit.

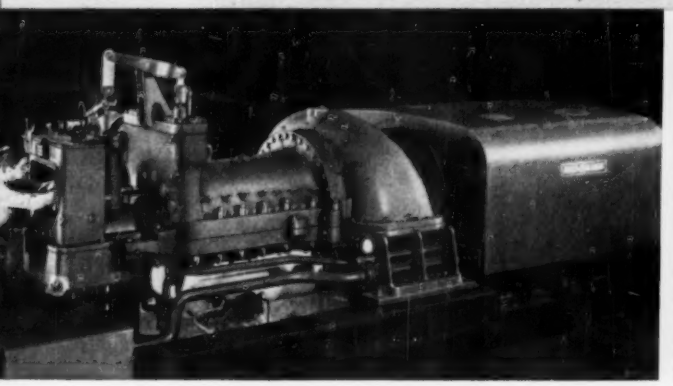


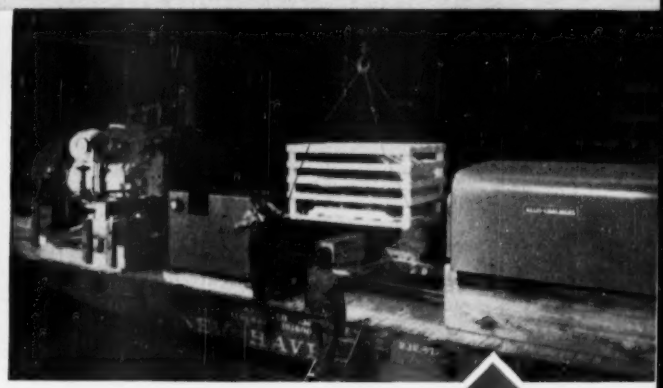
Installed and running ... the WA-Series unit: 3000 kw, 3600 rpm, 400 psig, 750° F, 2 in. Hg abs.

to Shipment!

3 Assembled 3-bearing unit — complete with housing type air cooled generator — ready for factory testing. Both oil piping and generator air coolers are above the floor line.

4 Entire WA-Series 3000-kw unit—pre-tested and insulated—being loaded on one flatcar for unit shipment. Both turbine and generator are shipped with their rotors securely locked in place.





ALLIS-CHALMERS

World's Widest Range of Power Plant Equipment

A-C ALLIS-CHALMERS

Harnessing heat for all industry

HEAT is one of man's most useful servants. With it, he can separate gasoline from crude oil . . . cook food . . . generate electricity . . . refine steel from raw ore and roll it into mile-long sheets. But to do these and countless other jobs, heat must be applied in the correct amounts . . . to obtain critical temperature values.

Forward-looking research and production men realized some years ago that "rule of thumb" was entirely inadequate for replacing complex processes. They needed facts obtainable only from automatic measurement . . . performance possible only through automatic control.

Honeywell has consistently led the way toward new and better temperature instrumentation. Continuing research has developed sensing elements which cover the full temperature spectrum . . . instruments which provide the desired accuracy . . . and automatic controls which can regulate any production process.

instruments

The complete Honeywell family offers a broad choice of characteristics to suit individual applications. *ElectroniK* indicators, circular chart and strip chart recorders and controllers afford the peak in performance through "Continuous Balance" high-speed electronic measurement. *Pyr-O-Vane* millivoltmeter instruments fit many processes which need accurate indication and control. Brown Thermometers are economical instruments for recording and controlling moderate temperatures.

controls

With *Pyr-O-Vane* instruments you can have electric control of either the two-position, three-position or time-proportioning types.

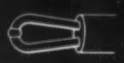
With Thermometers, you may choose from electric two-position, pneumatic on-off or proportioning control, and cam-operated program control.

With *ElectroniK* instruments, your selection covers practically any form of electric or pneumatic control, including the most advanced types suitable for complex processes, and the most flexible program controls.

Watch 270 plant *with the*

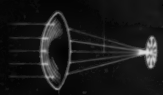
sensing elements

thermocouples



the most versatile of temperature elements, are supplied for ranges from −300 to +2800° F.

Radiamatic



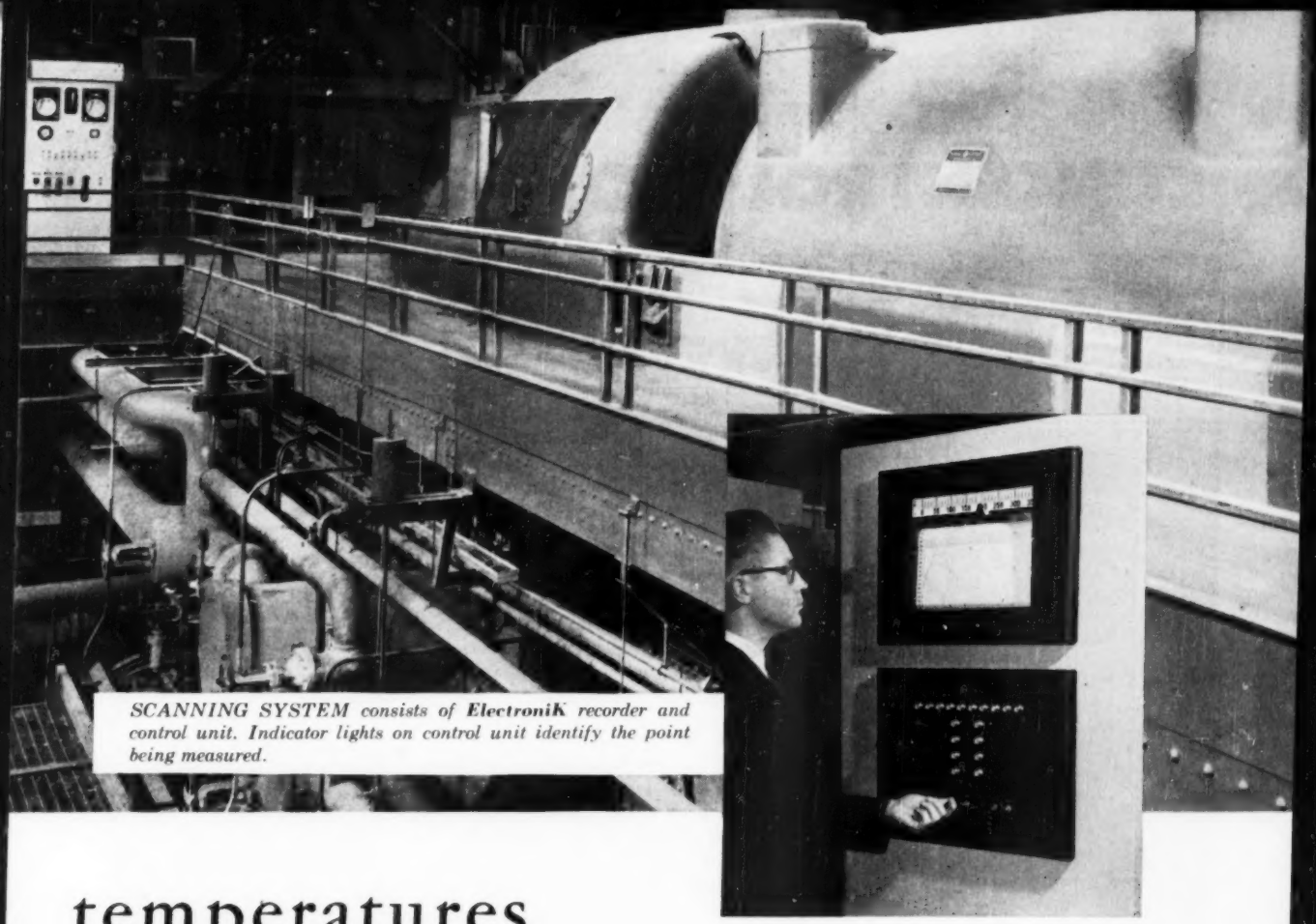
(radiation-type) elements are applicable to direct measurement of work temperature . . . to moving objects . . . to extremely high ranges and other jobs impossible for any other element.

resistance thermometers

are recommended for highest accuracy from sub-zero to 300° F. and for narrow spans.

thermometer bulbs

rugged, sensitive elements for moderate temperatures.



SCANNING SYSTEM consists of ***ElectroniK*** *recorder and control unit. Indicator lights on control unit identify the point being measured.*

temperatures *ElectroniK* scanner

IT'S EASY and economical to keep constant watch over temperatures of potential trouble spots throughout the plant, when you have an *ElectroniK* Scanning System. From a central point, you can monitor temperatures of bearings, hydraulic couplings, boiler tubes, cooling oil lines . . . at surprisingly low cost per point.

This instrument can concentrate data from as many as 270 different locations. It scans through successive thermocouple points at a rate as fast as one second per point . . . re-checking each point at approximately four-minute intervals.

At the operator's choice, it can perform these various functions: simple scanning without recording, continuous recording of all 270 points, selective recording, recording of points which depart from specified limits, and operation of annunciator contacts when any temperature exceeds a pre-set point. The chart moves only when the instrument is actually recording. Separate temperature limits can be set for each bank of 9 thermocouples.

Your local Honeywell engineering representative will be glad to discuss how this instrument can help you protect plant equipment economically. Call him today . . . he is as near as your phone.

MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, 4587 Wayne Ave., Philadelphia 44, Penna.

● **REFERENCE DATA: Write for Data Sheet No. 10.0-9, "*ElectroniK* Scanning System," and Catalog 90-2, "Supervisory Instruments for Power Generation."**

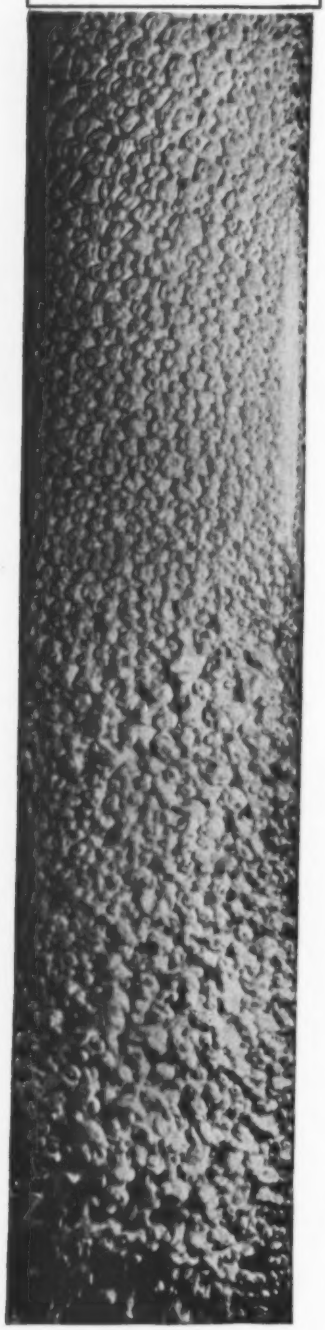
MINNEAPOLIS
Honeywell
BROWN INSTRUMENTS
First in Controls

For more data circle 518 on Post Card

CONCENTROL STOPS FOAMING

BEFORE

Laboratory demonstration shows foaming of highly alkaline solution in test cylinder.



This laboratory demonstration shows — as do scores of successful installations — that Bird-Archer's Concentrol is a highly effective anti-foam agent. It quickly stabilizes alkaline boiler water . . . eliminates foaming action and carryover. With Concentrol, you can forget about bouncing water gages. You get good quality dry steam every hour of every day.

Concentrol is available in liquid, powdered or briquette forms. Special Concentrol formulations are also available containing other commonly used boiler water treatment chemicals such as tannins, phosphates, alkalies, sulfite, etc.

See for yourself how economical Concentrol helps improve steam quality. Your Bird-Archer representative will demonstrate Concentrol in your plant . . . make specific recommendations for its use. Consult him, or write direct to Bird-Archer, outlining the details of your boiler operation.

FREE DATA SHEET AVAILABLE

HOW CONCENTROL WORKS

Concentrol works by effecting a rapid change in surface tension of steam bubbles which permit coalescence of small steam bubbles into bubbles of larger sizes. This results in the formation of unstable bubble films which break readily upon reaching the steam disengaging surface of the boiler water. This does away with foam build-up and subsequent carryover.

BIRD · ARCHER
WATER TREATMENT

THE BIRD-ARCHER COMPANY
4337 North American St., Philadelphia 40, Pa.
NEW YORK • CHICAGO

IN CANADA
The Bird-Archer Co., Limited
Cobourg, Ontario

IN MEXICO
Calderas y Accesorios, S. A.
Amsterdam 291, Mexico D. F.

BA 162

AFTER

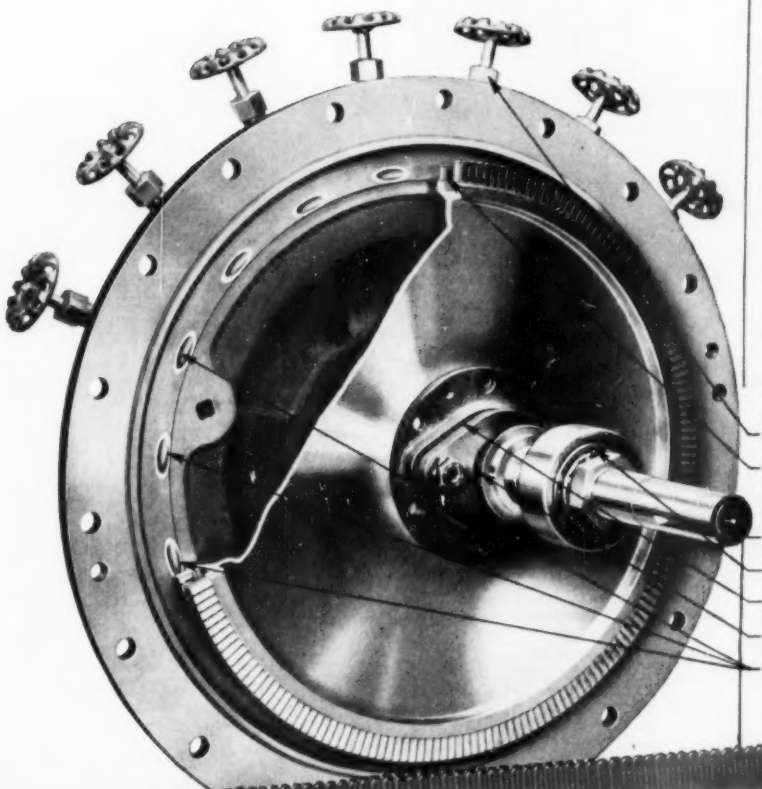
Same solution after addition of 12 ppm of Concentrol Anti-foam. Constant heat conditions were maintained during test.

For more data circle 519 on Post Card

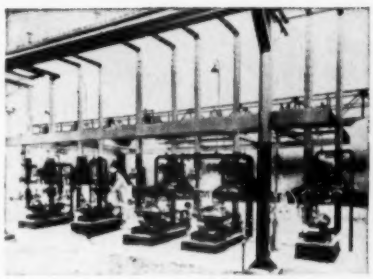
No other steam turbine offers you

SUCH VERSATILE STEAM NOZZLE CONTROL

The larger number of hand valves you see on a Coppus Steam Turbine promises you greater operating economy. At least 60% of the steam nozzles can be individually controlled to give maximum steam pressure in steam chest . . . a guarantee of best water rates at any load. Maintenance economy, too, is assured by the hard chromium plating of the shaft at the stuffing box. It provides the best possible smooth, non-corrosive surface for packing rings.



- 7 hand valves for efficient partial load operation, (20" turbine shown)
- 2 row velocity-stage turbine wheel with stainless steel turbine buckets — statically and dynamically balanced
- 30-40 carbon steel shaft
- Oversized double row deep grooved ball bearing
- Stuffing box with metallic packing ring
- Heavy chrome plating of shaft through stuffing box
- 3 nozzles always open



Coppus Steam Turbines, Type TF, driving chemical transfer pumps at Celanese Corporation of America's Chemcel Plant

Coppus Steam Turbines ranging from 150 hp down to fractional in 6 frame sizes

MAKE TURBINE DOLLARS GO FARTHER

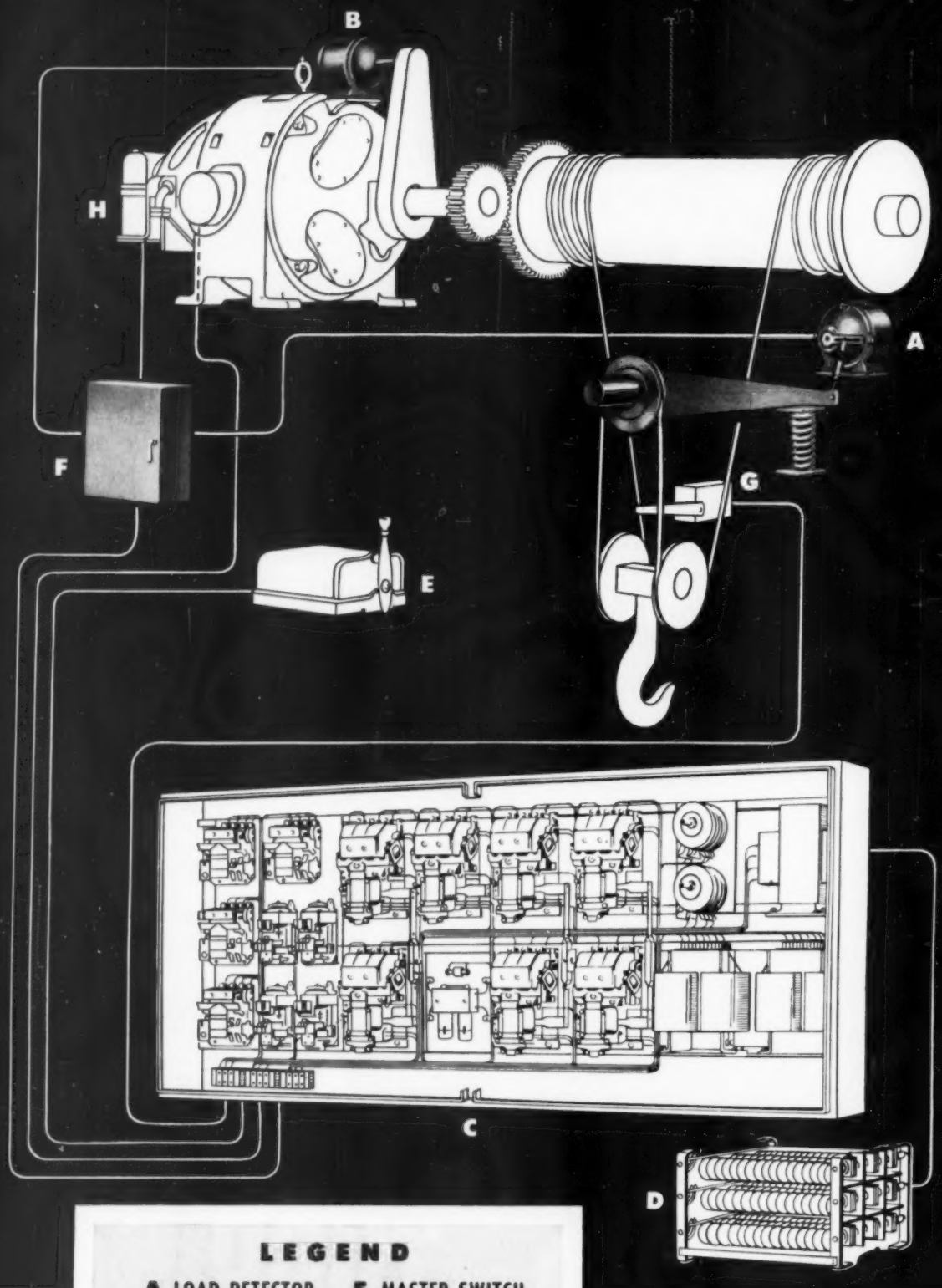
Why waste money buying turbines with higher horsepower ratings than you need? The higher the horsepower rating, the higher the price. Save money by selecting the Coppus Turbine size closest to your requirements from 150 hp down to fractional. And when you do, you save operating and maintenance costs, too. That's what these other Coppus features are designed to do: exclusive pilot operated excess speed safety trip supplementing constant speed governor; choice of metallic or carbon ring packing assemblies. Designs available for back pressures up to 75 pounds; replaceable cartridge type bearing housings. For full details . . .

WRITE FOR BULLETIN 135

COPPUS ENGINEERING CORP., 162 Park Avenue, Worcester 2, Mass. Sales offices in THOMAS' REGISTER.

COPPUS "BLUE RIBBON" TURBINES

For more data circle 520 on Post Card



LEGEND

- **A** LOAD DETECTOR
- **B** PILOT GENERATOR
- **C** MAGNETIC CONTROLLER
- **D** RESISTOR
- **E** MASTER SWITCH
- **F** DYNAMIC BRAKING UNIT
- **G** LIMIT SWITCH
- **H** HOLDING BRAKE

NEW LOAD-O-MATIC

A-C CRANE HOIST CONTROL

Here's the new Westinghouse Load-O-Matic Crane Hoist Control that divorces torque from speed and permits the co-ordination of speed and load to suit the requirements of each particular installation.

Key is the Automatic Load Detector shown on the schematic drawing at the left. This mechanism measures the weight of the load suspended on the hook and, through the medium of the main circuit, uses this intelligence to control the power delivered to the hoist motor. Thus, motor torque depends primarily on hook load.

This means—*precise crane performance.* Loads can be accurately spotted without the necessity of jogging or inching. Operator can actually float the load into the desired spot. Overshooting is eliminated. Crane operation can be delegated to semi-skilled operators.

Load-O-Matic offers you these exclusive features:

SLOWER STABILIZED CREEPING SPEED throughout the load range than for any other a-c system.

DECREASE IN SPEED WITH INCREASE OF LOAD on first two points, hoist and lower—safer and surer handling.

MINIMUM MOTOR SIZE for a given crane—less motor input current is required than for any other electrical braking system.

DYNAMIC BRAKING to prevent dropping of load in case of power or brake failure.

LOAD DETECTOR PREVENTS LIFTING EXCESSIVE LOADS by operating signal or by shutting off power.

LONGER CONTACTOR LIFE—saturable reactor excitation gives speed control for positioning . . . fewer contactor operations. J-27014-A

SEND FOR FREE BOOK. Complete details of the new Westinghouse Load-O-Matic A-C Crane Hoist Control are contained in this booklet. Send for your free copy today. Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania.

YOU CAN BE SURE...IF IT'S Westinghouse

For more data circle 521 on Post Card

If you use water industrially (or industriously):
WATCH THIS SPACE
in future
Nalco ADS
for up-to-date help with your job
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Helpful Bulletins

THE ANSWERS to many of your operating and maintenance problems are found in these new and recently revised catalogs and bulletins. Circle item numbers of all catalogs wanted on the postage-free card below, detach and mail

INSTRUMENTS AND CONTROLS

101 Control Centers — This 31-pp application booklet (B-5621) on control centers stresses the case for centralising all controls of an entire system in one group of enclosures. Discusses the characteristics of control centers that make for flexibility of use, ease of servicing, safety. Three types are described, and the various electrical components that make up typical units are illustrated. A three-step building-block system of planning control centers is given, along with check charts on arrangement. Selection tables are included. Westinghouse Electric Corp.

102 Control Equipment — Catalog 003, 32 pp, presents company's equipment for the control of liquids and gases for water and sewage works, power and process industries. A well illustrated booklet, it lists many types of controllers, gages, manometers, valves, venturi tubes. Descriptions of the units, their operating characteristics, construction details, mountings, specifications and other data included. Simplex Valve & Meter Co.

103 For Improved Oxygen Control — Bulletin 108 presents advantages of manufacturer's Model F-3 oxygen analyser: automatic operation, high selectivity to oxygen, low maintenance, rugged construction etc. Explains paramagnetic principle of operation, discusses easily installed components. Includes applications. Arnold O. Beckman Inc.

104 Panel Planning Ideas — The engineering and economical planning of modern combustion and process control panels is discussed in 3-pp Bulletin 170. Numerous panel designs, fashioned for control, are illustrated along with the most up-to-date methods of tubing and wiring. A section on accessories helps make this a valuable source book of ideas for control station planners. Bailey Meter Co.

105 How Many Btu's — Instrumentation Data Sheet 10.19-1 describes operation and application of the Brown Btu meter, which simultaneously records differential temperature and flow of a liquid and provides direct reading of Btu. Brown Instruments Div., Minneapolis-Honeywell Regulator Co.

106 Timing Relays — This 16-pp bulletin featuring timing relays describes fluid dashpot, pneumatic and electronic timers. Also contains complete operation and engineering data. Applications are stated and timers are shown in a variety of standard enclosures. Also provided is a selector chart with suggestions on factors to consider in choosing a timing relay. Allen-Bradley Co.

107 For Metering Natural Gas — Bulletin 1701 tells advantages to be gained by installing precision bored tubes in connection with flowmeter orifices. Explains how the precision machine bored meter run gives standardized performance of measurement and permits use of any beta ratio. Dravo Corp.

GAS, OIL BURNERS

108 Dual-Stage Oil Burners — Bulletin 25 describes oil burners designed to offer advantages of both steam and mechanical atomization. Explains how the two stages are provided, illustrates construction, gives specifications. Also discusses briefly control systems suggested for use with forced-draft and induced-draft furnaces. National Airoil Burner Co., Inc.

109 Boiler-Burner Units — Fourteen-pp Form 2314 is a catalog providing full descriptive information and other data on the entire line of Kewanee-Iron Fireman boiler-burner units. Arranged for easy selection of the proper unit for any particular application to high or low pressure heating, power or process steam. Kewanee-Ross Corp.

110 Oil and Gas Burners — Eight-pp Bulletin P-152 illustrates and describes manufacturer's Pac-O-Matic oil, gas and combination burners for industrial process and institutional applications. Tells advantages of the packaged unit, explains special features. Lists components and includes selection information on components; gives performance data. Coen Co.

VALVES, TRAPS, PIPING

111 Bonnet Valves — Form AD-1902, 8 pp, presents manufacturer's Lip-Seal steel bonnet valves, 1500- and 2500-lb globe and angle types for power services. Shows how their design meets requirements for high-pressure/high-temperature power plant service, gives construction details, pictures some installations. Includes tables of materials and service ratings, sizes and dimensions. Crane Co.

112 For Quick Valve Selection — Here's a 20-pp catalog digest providing ordering and application information on gate, globe, angle and check valves in bronze, iron, cast and forged steel construction, also valve accessories and parts. Illustrated and thumb indexed, includes pressure-temperature chart. The Ohio Injector Co.

113 Relief Valves, Other Equipment — Bulletin C-49 is an 8-pp condensed catalog covering company's boiler water feeders, low water fuel cut-offs, pump controls and relief valves — including new temperature relief valves and combination temperature-pressure relief valves. Information is arranged to simplify selection of proper equipment and is complete with prices. McDonnell & Miller, Inc.

114 Small Steam Trap — Bulletin 351 describes an industrial steam trap in sizes from ¾ to ¾ in. for pressures to

FEBRUARY, 1953
Card void in 6 months

POWER ENGINEERING

Please have the manufacturers send me without obligation information on bulletins indicated by the numbers circled below.

Name ..... Title .....

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605																									

Use this space to ask for heat sheets and other information. .....

200 lb, and recommended for individual drainage of small pieces of steam-using equipment. Tells how trap is built, how it works; gives prices, dimensions and capacity data. W. H. Nicholson & Co.

115 Insulated Pipe — This illustrated bulletin discusses construction and applications of company's Pre-sealed insulated pipe, described as an insulated conduit which does not depend on a metal jacket for protection from moisture, leakage and corrosion. Explains field joint procedure, also covers anchors and end caps for use with pipe. Durant Insulated Pipe Co.

116 Head Loss Data on Plastic Pipe — Authoritative data has been compiled on head loss due to friction in plastic pipe and is available to power engineers in the form of charts and graphs. They are based on a combination of this manufacturer's own experience and a compilation of data derived from a check of flow properties by hydraulic laboratories. Carlon Products Corp.

117 Thread Manual — Catalog C-52 is a 24 pp booklet covering design information, gaging information and specifications for the three major standard pipe thread systems, as well as specifications for taper and straight pipe taps, thread plug and ring gages and plain plug and ring gages. Tabular matter provided includes basic pipe thread dimensions common to American Standard, American Standard Dryseal and Military Aeronautical pipe threads. Suggested tapping and gaging procedures are included. Detroit Tap and Tool Co.

118 Swing Joints — Detailed information on ball-bearing equipped swing joints is presented in 8-pp Catalog 400. These new joints are designed for loading and unloading lines handling oils and gasoline, gas and many chemicals. Single and double swing styles are shown; specifications, dimensions and working pressure ratings included. Barco Mfg. Co.

ELECTRICAL

119 Transformer Accuracy Standards — Sixteen-pp Bulletin GET-1366A on instrument transformer accuracy standards is offered to facilitate selection of proper instrument transformers for any application. Lists accuracy standards for potential transformers, metering current transformers and relaying current transformers. Diagrams show graphical equivalents of ASA accuracy classes. General Electric Co.

120 Current Transformer Application Guide — Twelve-pp Bulletin GEA-5874, on company's indoor-outdoor butyl-molded current transformers, contains descriptions of typical indoor and outdoor uses of current transformers with ratings 200 to 800 amp. Also includes typical wiring diagrams, burden accuracy charts, and primary conductor information. General Electric Co.

121 Trolley Busway System — Details and specifications of a heavy-duty industrial trolley busway system are presented in 16-pp Catalog 30. Available in single- and three-phase standardized prefabricated units the new system offers 250-375-500 amp current carrying capacity. Provides design and construction features of tracks, trolleys, feed boxes and accessories. Fully illustrated with photos and sketches, booklet also discusses methods of mounting. Feedrail Corp.

122 What's Said About Silicone Insulation — Eight-pp Form 10-100 is a booklet of condensed reports on operating conditions and performance of equipment insulated with Silicone (Class H) electrical insulation. These are case histories in which such equipment was specified by maintenance and production men for use where overloads had caused frequent failure, where high ambient temperatures limited motor life, where rapidly reversing motor service caused premature failure, where motors failed because of excessive moisture and where the cost of down-time was prohibitive. Dow Corning Corp.

123 Putty Insulation Compound — Form E-SF describes and pictures the use of a new electrical insulation putty which comes in a roll and applies like tape but soon fuses into a homogenous mass. Discusses cleanliness, ease of application, easy cable splice build-up and other advantages. Gives physical, electrical properties. Minnesota Mining & Mfg. Co.

124 Electric Power for Water Plants — Form GER-678 is an 8-pp article describing electric power distribution and equipment for water plants. Well illustrated, it reviews the planning of water plant power installations from the standpoint of avoiding extended interruption of service without materially increasing costs. Also discusses electric power equipment used in power plants. General Electric Co.

125 Permanent-Magnet Motors — Bulletin F-4344 describes and pictures permanent-magnet motors with electrically balanced armatures to insure low radio noise level, higher efficiency and longer brush life. Gives design features and adaptations. Barber-Colman Co.

Another post card is provided for your use on pages 135-136

PUMPS, COMPRESSORS

128 Pumps for Industry — Industrial Catalog I-52 contains 96 pp of illustrated information about numerous types of pumps and includes sectional and exterior views of the various types of units, together with selection tables and pertinent data. Presents many standard types of centrifugal pumps, sump pumps, sewage pumps, vertical turbine pumps, condensation return units, rotary pumps, horizontal and vertical piston pumps, deep well reciprocating pumps and many others, as well as accessories. The Deming Co.

129 Close-Coupled Pump — Construction features of company's supporting-adapter type, close-coupled general purpose pump in capacities to 2500 gpm at heads to 550 ft are described and shown in Bulletin 52B6083A. Alternate sealing arrangements available are diagrammed, sizes given. Allis-Chalmers Mfg. Co.

(Continued on page 185)

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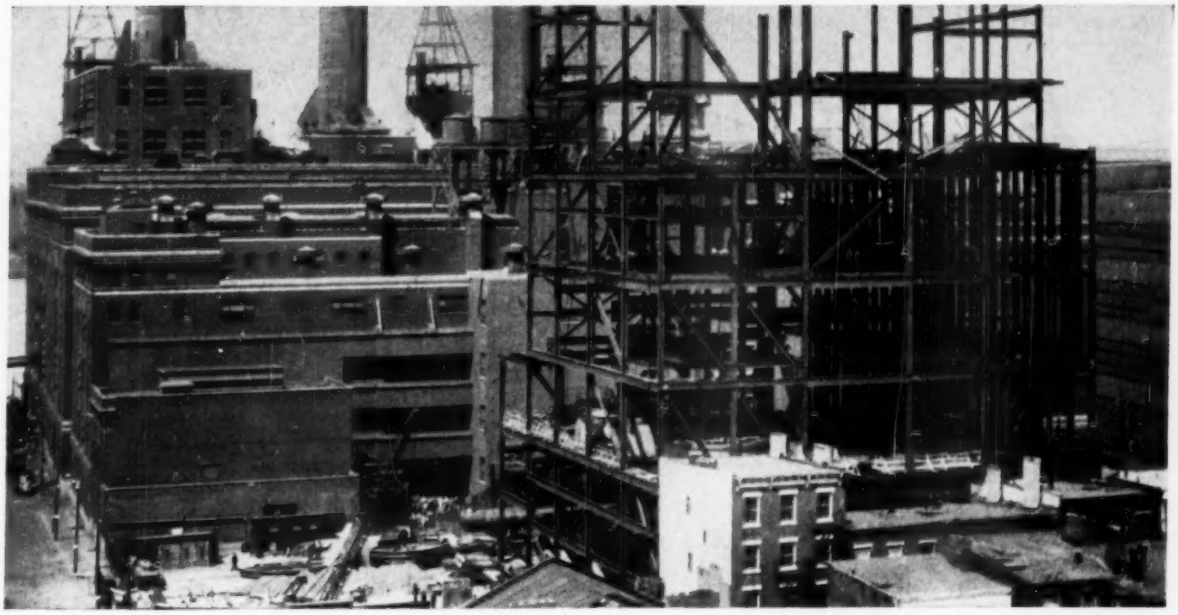
CHEMICAL CLEANING REMOVED MILL SCALE FROM BOILER AFTER ERECTION

Dowell service gave quick, effective cleaning assuring more efficient operation



To provide more extensive service for its customers, a large power company installed a new 1,370,000 lb. per hour boiler. Specifications on this equipment called for Dowell Chemical Cleaning Service to remove the mill scale from the boiler *after erection*.

To remove the mill scale, Dowell engineers filled the boiler with solvents especially designed for the job. Using Dowell's equipment, manpower, and pump trucks, the entire cleaning job was performed in a few hours.

The removal of mill scale *after* equipment is erected can eliminate much of the extra care required in the handling of previously sand blasted or pickled tubes. It may also substitute for the grease-removing alkaline preboil, thus saving considerable time and money. Unless it is removed, mill scale may retard heat transfer, slough off abrading particles, and act as a base for further corrosion.

Maintenance engineers in industrial plants throughout the country have learned to rely on Dowell Service for fast, effective and economical cleaning of their operating equipment. How about you?

Experienced Dowell engineers are available to make estimates on your particular problems. Call Dowell today, or write directly to Tulsa, Dept. B24.

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Over 100 Offices to Serve You with Chemical Cleaning for:

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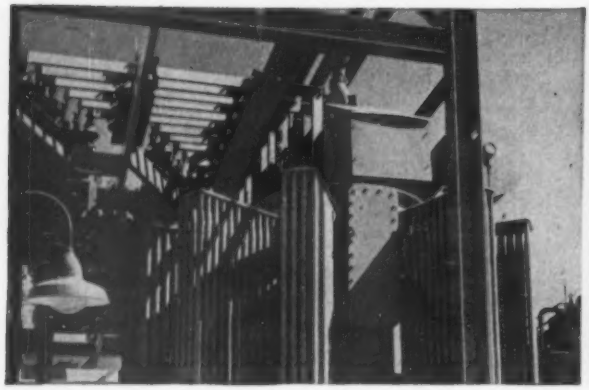
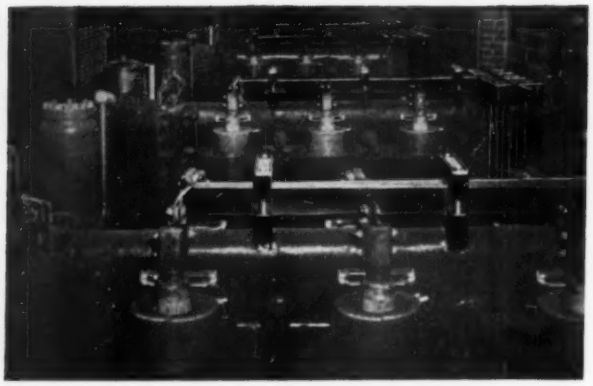
For more data circle 523 on Post Card

It takes a Lot of Copper to make a Lot of Chemicals!





These photographs show a lot of copper bus bar in a new plant of a great chemical company, whose name and location cannot be disclosed. The copper carries heavy currents to electro-chemical equipment for the production of valuable products used in national defense and in industry. Revere furnished 325,000 pounds of bus bar for this service, the bar going into substations, rectifier stations, and cell houses. In addition, at the time of installation the Revere Technical Advisory Service collaborated with the customer in working out some difficult details in the design of switches. If you need electrical conductors, remember that copper has the highest electrical conductivity of all the commercial metals, that Revere makes bus bar, and that the Revere Technical Advisory Service is always ready to work with you on any problem concerning copper and its alloys or aluminum alloys. Call the nearest Revere Sales Office.

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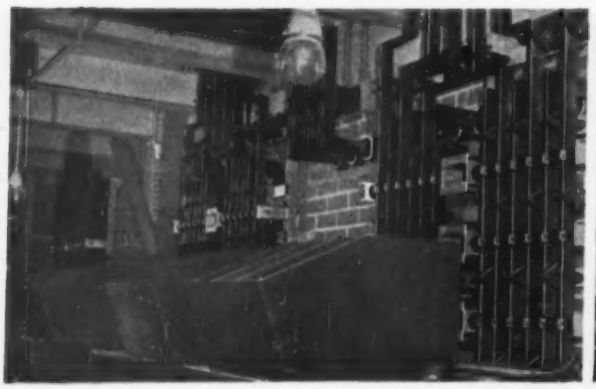
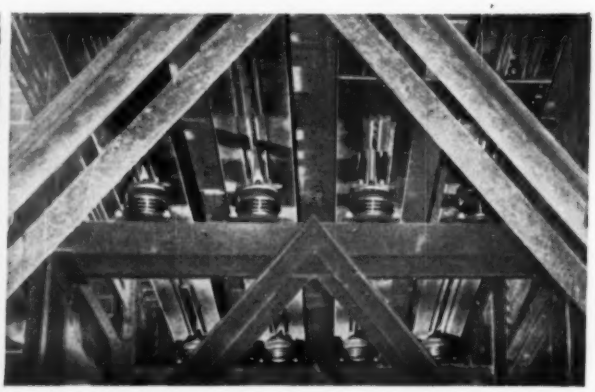
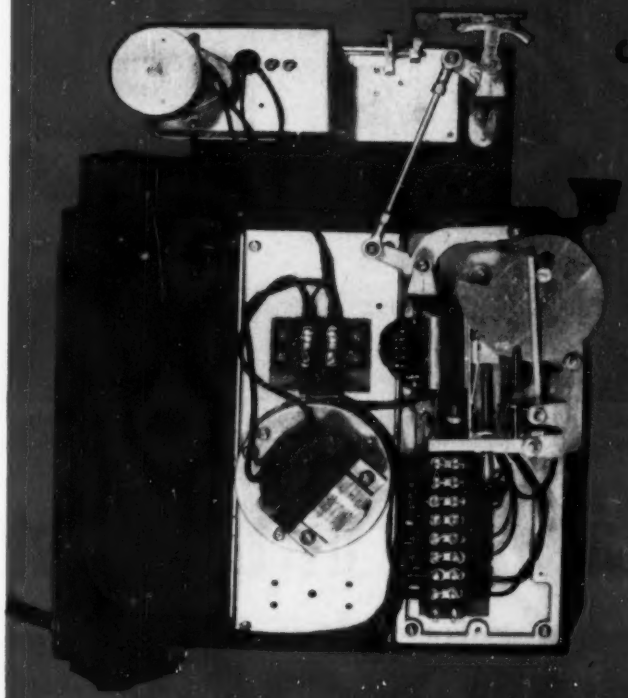




For more data circle 524 on Post Card

a new electronic flow meter!



Choice of 3 mercury-less transmitters

Hays Barton flow or differential transmitter

Hays differential transmitter

Hays liquid level transmitter

continuous integration —no creep at zero

unaffected by normal voltage, frequency and temperature changes

electronic operation provides high speed and greater accuracy

3 to 1 range calibration at recorder

HAYS Electronic Flow Meter

Since the circuit is of the electronic null-balance type, it is unaffected by normal voltage and frequency variations. Also, neither temperature variations nor reasonable length of transmission lines affect the calibration of the instrument.

The *pen-drive motor* is built for reversing duty. Normal variations in voltage and frequency have no noticeable effect on its operation.

The *integrator* is continuous in operation and simple in mechanical construction. A micrometer zero adjustment for calibration is easily accessible.

Indicators can be calibrated to read directly in rate-of-flow or other factors as desired.

Write today for full information on the Hays Electronic Flow Meter Bulletin 52-1074-222.

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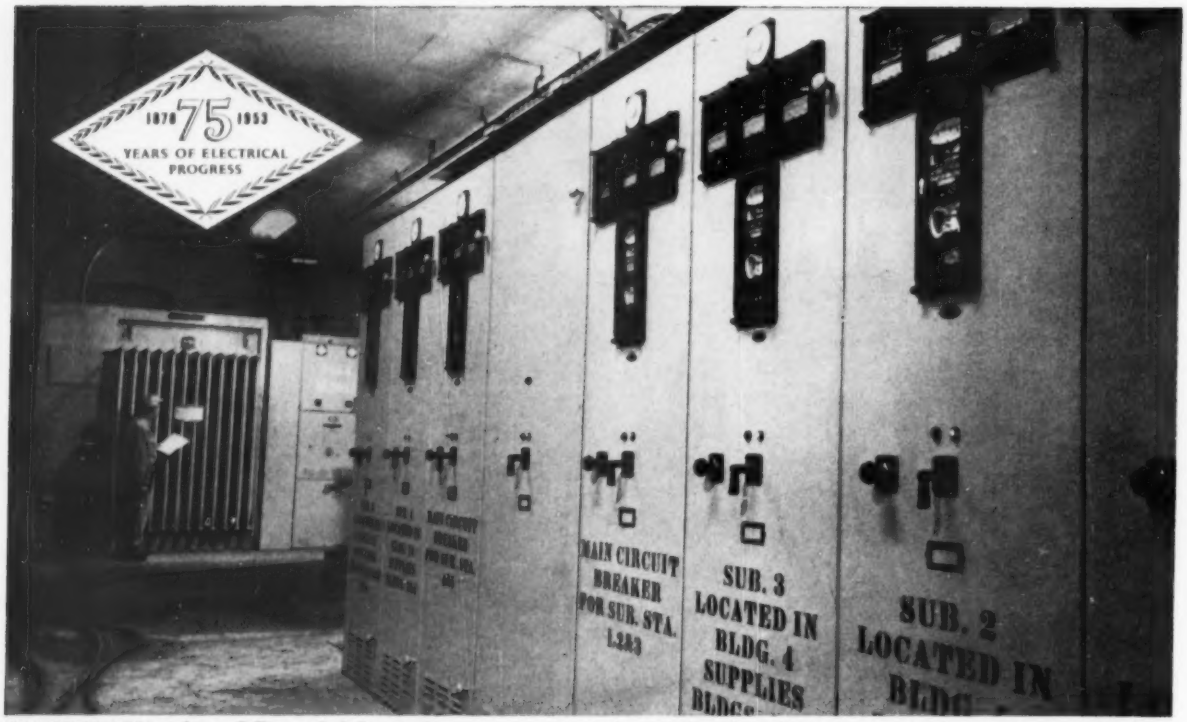
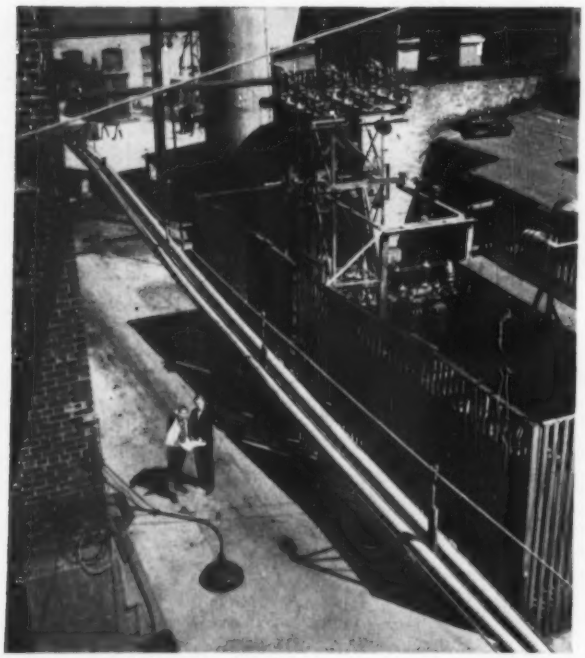

1878 75 1953
YEARS OF ELECTRICAL PROGRESS
MAIN CIRCUIT BREAKER FOR SUB. STA. 1-2&3
SUB. 3 LOCATED IN BLDG. 4 SUPPLIES
SUB. 2 LOCATED IN

KAISER-FRAZER selects G-E metal-clad switchgear to power modernized parts plant. Increased safety, protection against power shut-downs are provided by this 8-compartment, 4.16-kv lineup. Switchgear has two incoming line sections, tie breaker, five feeders—each feeding a 1000-kva load center, such as Substation No. 4 in background.

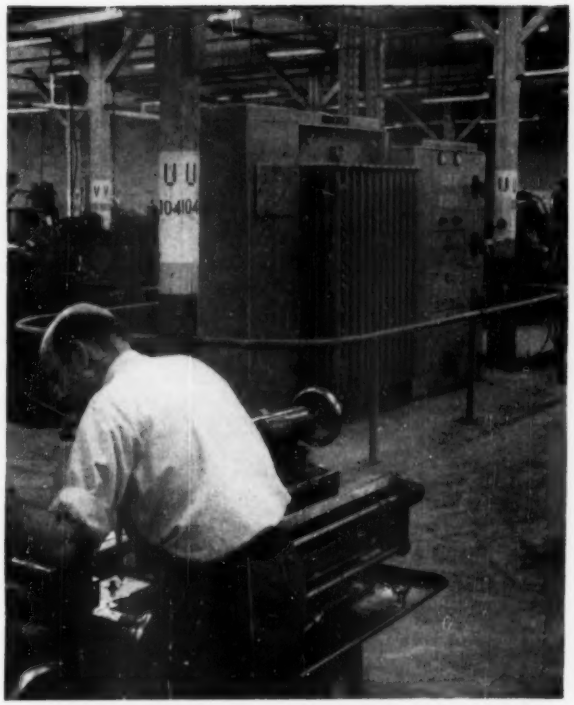
Kaiser-Frazer installs one of the most



EASILY installed armored cable, in center, replaces maze of old low-voltage cables at right—saves tons of copper.

TOOL ROOM shows interlocked armor cable leading to junction box, Trumbull Flex-A-Power* bus duct with plug-in connections.

FOR SWITCHGEAR CONNECTIONS, 700 feet of interlocked armor cable were pulled into position in 45 minutes. Cable can go under, over pipes, rafters, beams.



G-E UNIT SUBSTATION, one of five 1000-kva Pyranol* 4160-480Y/277 load centers in Kaiser-Frazer plant, powers nearby machines. Rail protects substation from battering of trucks.

modern plant power systems in America

New G-E metal-clad switchgear and radial load-center distribution system replace obsolete low-voltage system

In modernizing a factory in Dowagiac, Mich., for use as a parts plant, Kaiser-Frazer Company turned to General Electric for a complete electrical job.

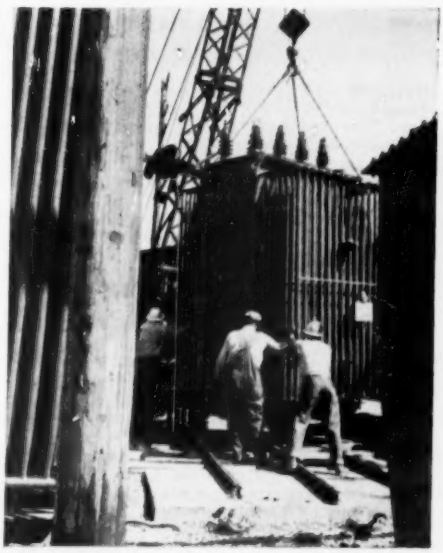
A very important phase was the G-E engineered distribution system, installed by Koontz-Wagner Electric Company, Inc., of South Bend. This system features new, standardized metal-clad switchgear . . . replaces dangerous, inadequate equipment inside and outside the factory.

Two 3000-kva transformers, equipped with load ratio control, feed metal-clad switchgear through flexible interlocked armor cable. The compact, safe, metal-clad lineup, rated at 4.16-kv, in turn feeds five 1000-kva load centers in a reliable radial distribution system. High-voltage fluorescent lighting considerably reduces equipment costs. Neutral grounding increases system reliability and economy.

Kaiser-Frazer, with pre-assembled G-E equipment, has saved months of time, cut installation and maintenance costs, provided greater safety, and made the best possible use of plant space.

For information to help in your modernization plans, contact your local G-E sales representative—or write direct to General Electric Company, Schenectady 5, N. Y. 8741

*Reg. Trademark of General Electric Company.



TWO TRANSFORMERS, 3000-kva, 27-4.16-kv with load ratio control, are installed by contractor.

GENERAL ELECTRIC

For more data circle 526 on Post Card

Equipment News

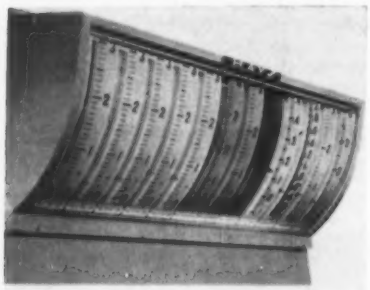
SUMMARIZED HERE are new products and improved ones . . . recent developments of leading manufacturers who will gladly supply further information at no cost. You may use the no-obligation, postage-free cards on pages 38 and 136 for your request. Just circle numbers of the items you'd like to know more about

1—DRAFT GAGE

With 3-way atmospheric vent and other new design features

Among new features announced for the Vertiscale are easy "one-man" zero check; large identification label space; magnetic access door; fluorescent lighting; removable units; no parallax; and Lucite scales. Like company's other draft and low pressure instruments, the Vertiscale's basic operating mechanism is a diaphragm, enclosed in a cast metal housing, the force and movement of which is balanced against the force of calibrating springs. The resulting force and movement of the diaphragm is transmitted through linkage to the pointer to indicate the magnitude of the draft pressure or differential to which the diaphragm element is subjected.

From one to 12 Vertiscale units can be



ounted side by side in a single case. our types of mounting are available: semi-flush; eye level; recessed, for above eye-level reading; and protected or lug mounting. Gages can be obtained with a spring loaded metallic bellows for indicating functions. Ranges from 0.2 to 120 in. of water, draft and differential can be provided. Bulletin 52-1060-210 gives details. The Hays Corp.

2—PENETRATING COMPOUND

For electrical connections, now comes in handy 5-oz tubes

For easy on-the-job application of Penetrox A, this oxide-penetrating, corrosion-inhibiting compound for electrical connections involving aluminum now comes in a 5-oz tube with protruding spout. Each tube is cartonned in cardboard, with directions printed on both tube and carton. Penetrox A is also available in pint, quart, and gallon cans. Burndy Engineering Co. Inc.

3—VALVE HANDWHEEL

Is designed to turn easily and safely and not slip, permit tight closing

This new "non-slip" handwheel is said to represent a scientific departure from the conventional type of valve wheel and will be standard on manufacturer's complete line of bronze and iron valves formerly equipped with regular-type handwheels. Like its predecessor, the new handwheel is of malleable iron.

The new model features four finger-spaced lugs, all continuations of the strong spoke structure, projecting from the stem hub through a rugged octagonal frame. This design lets the operator get a firm, comfortable grip on the handwheel and apply a high pressure, it is explained — even though his hand may be wet or greasy. The handwheel is shaped to prevent possibility of burned hands from contact with valve stem, and because of the sure grip afforded, it is said to assure tight closing. The Lunkenheimer Co.

4—INSULATING TAPE

Offers increased abrasion resistance and tensile strength

Bi-Seal Type V is a new self-bonding electrical insulating tape said to offer all characteristics of company's Bi-Seal, but with greater abrasion resistance, tensile and dielectric strength (over 1000 v per mil). It is announced as ideally suited to wire and cable splicing, as it affords water-, acid-, alkali-, corrosion- and weather-proofness. It's also said to be impervious to ozone and oxygen.

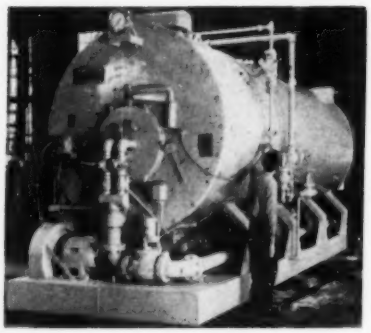
Like its predecessor, the new Type V is a polyethylene based compound that fuses into a solid homogenous mass when applied. It's easily applied in close clearances and has no right or wrong side — both sides are usable. Bi-Seal Type V can be applied at temperatures as low as −40 F. Manufacturer says it's UL approved as a splice insulation for rubber and thermo-plastic insulated wires and cables when temperatures do not exceed 80 C and when covered with friction tape. Comes in clear or black, in 30 ft rolls, in widths of ½, ¾ and 1 in. Bishop Mfg. Corp.

5—FLAT-SIDED CONDUIT

Is non-metallic, for use in underground duct systems

For concrete-encased underground power and communication circuits this non-metallic conduit is available in a flat-sided design. The flat sides permit multi-way duct systems to be built up quickly and accurately without use of spacers, it is noted, and this is particularly advantageous for communication circuits

and for power circuits which do not require wide spacing between ways. The new conduit has the same characteristics as manufacturer's round conduit. Soapstone Duct Co.



6—STEAM GENERATOR

Is 600 hp unit, for firing with oil, gas or oil-gas combinations

With the addition of this new 600-hp unit, this manufacturer's Amesteam Generators are now available in 20 sizes, from 10 to 600 hp, for pressures from 15 to 200 lb steam and for oil-, gas-, or combination oil-gas firing. A light oil-gas combination unit, connected for gas firing, is pictured.

The generators in this line are fully automatic and self-contained, ready for operation when connected to steam, water, fuel and electric lines, and to breeching or stack. A feature is accessibility of parts. Automatic controls are in an eye-level panel box. Davit-hinged burner head and flue cover simplify inspection and servicing, and the rear flue cover is also davit-hinged, as is the one-piece rear baffle. Ames Iron Works.

7—FLOW METER

Measures liquids, steam, gas through standard differential producers

This new Flo-Watch model, the Afuaq, measures flow through venturi tubes, nozzles, and orifices and is also suited for use with Kennison open nozzles, flumes and weirs, and is said to be adaptable for any combination of totalizing, indicating or recording functions.

An extension of manufacturer's Flo-Watch line, the Afuaq is designed to offer the accuracy and dependability of the Flo-Watch at lower cost for those applications having a narrow flow range. The totalizer reads directly in quantity units such as gallons or cubic feet, and the indicator scale and chart graduations are arranged to provide maximum readability throughout the measuring range from 25 to 100 per cent of full scale. Bulletin 300-J14 gives details on the Afuaq and its adaptations. Builders-Providence, Inc.

8—STEEL VALVE

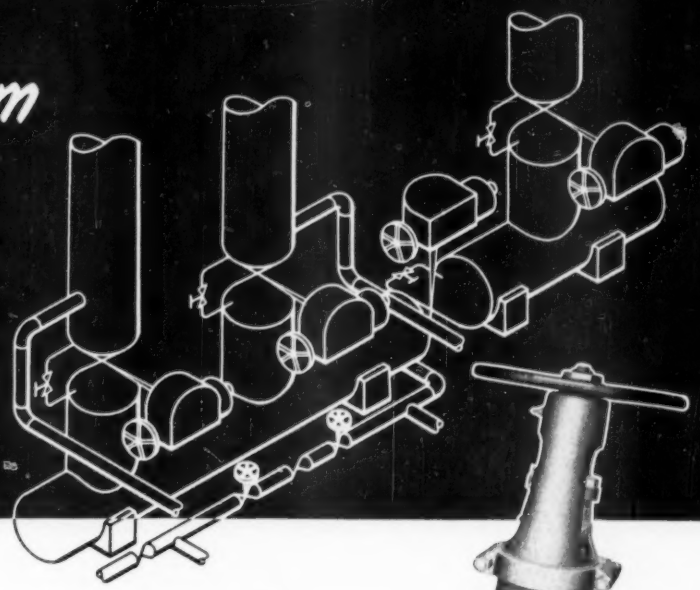
Self-tightening, is built with reversible seat and disc

The Harper-Velan Self-Tightening Valve is said to represent a major advance in steel valves for high pressure and high temperature power service. In this valve a combination seal and seat disc is used. The disc is pressure loaded on the differential area when the valve is closed, and it permits a slight downward movement during the closing action of the valve. If the seat is closed and the valve cools off, the seat ring is designed to follow the valve disc automatically to assure tightness to compensate repeated temperature variations. In addition, the valve has a reversible seat and disc, the unused portion of the disc being held

It's not what you Pay for Valves . . . it's what they Cost you

on Main Steam Lines for example

(A Case History)



Crane Pressure-Seal Bonnet Valves —gate, globe, angle, and stop check—in 600, 900, and 1500-Pound classes. See your Crane Catalog.

What you pay for valves is not the final criterion of value. Not when maintenance costs can quickly equal or exceed purchase price. A thrifty buyer knows his maintenance; knows also there's bigger value in better quality.

Take this case of main steam header valves in a midwestern public utility power station. One header is equipped with bolted bonnet valves. Another in identical service has Crane Pressure-Seal Bonnet Gates of identical size and pressure class.

Records on bolted bonnet valves show considerable repairs for seat leakage, and difficulty in keeping bonnet joints tight. Also trouble with discs sticking shut. In contrast, Crane Pressure-Seal Valves keep giving trouble-free, extra-cost-free service. Seats and bonnets stay tight as new; operation is smooth and positive.

Today, more than ever, you need greater assurance of dependability in piping materials. You get it in Crane valves—the standard of quality with thrifty buyers everywhere. Your big Crane Catalog offers complete selections for all needs. Your Crane Representative is always at your service.

CRANE VALVES

Crane Co., *General Offices:* 836 S. Michigan Ave., Chicago 5, Illinois
Branches and Wholesalers Serving All Industrial Areas.

VALVES • FITTINGS • PIPE • PLUMBING • HEATING

For more data circle 527 on Post Card

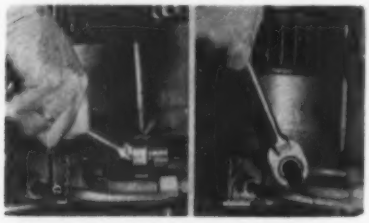
in reserve and protected against wear.

Parts subject to wear can be replaced without removal of the valve from the line. Concerning relative position of valve body and bonnet, the same valve can be used as a straight-way or angle type. Velan Engineering Co.

9—RATCHET WRENCH

Is designed to save time on difficult wrenching applications

Now available commercially is the TAC Open End Ratchet Wrench. This versatile tool is described as a ratcheting socket wrench that is open ended to permit introduction from any side of the socket over and completely around a pipe or tube and straight down on the fitting.



There the socket engages nut or bolt and ratchets it off or on as fast as the arm can swing.

According to manufacturer, it engages fittings by surrounding the standing center obstacle (pipe, conduit, long stud), the wrench head ratcheting by means of internal pawls. These act upon teeth cut into a strong ring which travels in a circular channel around the wrench head. It is claimed that as little as 7 deg clearance of the regulation square drive will permit normal functioning and danger of bending or chewing up the fitting — even soft copper.

The wrench has broad applications. Thin walled sockets incorporating strong steel alloys come in 64 sizes from ¾- to 4 in. making it possible to do the work of many wrenches. Additional adapters — turnbuckle, hex, square drive and rigid head, etc. — are also available. Tubing Appliance Co.

10—MASONRY SAW

Is designed for dust-free cutting of refractory shapes

Perfectly fitting shapes for the relining of furnaces, boilers, kilns and acid chambers are said to be made quickly and without dust with the Model DW Eveready Briksaw. Intricate cuts can be made right alongside the bricklayers or furnace builders, company points out, and the saw can be used inside in confined areas, even next to machinery. Dustless cutting is made possible by a high capacity centrifugal water pump, and dust and material particles are swept away in a constant water spray, it is explained, leaving the working area free of dust.

As an additional safety measure, the saw incorporates a "Snap-Lock" hinged blade guard that protects the operator from both blade and water spray. This saw may also be used for dry cutting, where dust isn't objectionable, without unhooking the water pump. Illustrated literature gives further details. Eveready Briksaw Co.

11—BOILER LEVEL INDICATOR

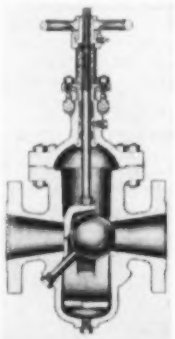
Is engineered for safety and convenience of application

This 12-in. dial indicator, operating on the differential pressure principle, can be mounted on a panel or pipe standard, bringing the dial to convenient eye level and enabling the operator to be constantly informed of water conditions. Numerals and micrometer pointer are white against a dull black dial for good reading even at a distance or in dim light. The indicator is available in standard ranges from 0-20 to 0-200 in. of water, and the forged steel body has a rated working pressure of 2000 psi. Bulletin 392 gives complete information. The Foxboro Co.

12—VENTURI BALL VALVES

Are designed to provide unusually accurate flow control

The disc in these Crane-Paul Valves, instead of being of conventional shape, is a ball, which is not attached directly to the stem, but rides in a cage attached to the stem by a tee-head slotted construction. In operation, the ball is moved to and from the center of flow and rolls into and out of the body seat. The ball disc is mechanically locked in the closed position by a wedging member on the cage. In moving to the fully open position, the ball rolls out of the seat and up, until lined up vertically with the stem and carried out of the path of flow.

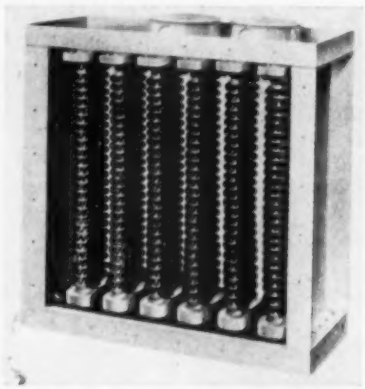


Besides accuracy of flow control with a minimum of wire drawing, the design is said to provide straight-through flow with much lower pressure drop than that through a globe valve, tight shutoff, easy operation, and freedom from chattering or vibration. The valves come in venturi patterns with flanged ends, in cast carbon steel or company's 18-8 Mo alloy steel, and in a wide range of sizes beginning at 1 in. Crane Co.

13—ELECTRIC HEATERS

Both unit heaters and heating sections, in wide range of sizes

Designed for applications where steam, hot water or gas is not available or economical to use, these heaters use the Hynes electric heating element, which features an arrangement of flexibly mounted insulators suitable for hard service up to 6000 v. The unit heaters deliver from 13,600 to 204,000 Btu's per hour and the heater sections, pictured, from 25,500 to 204,000 Btu's



per hour. The smallest unit discharges at the rate of 235 cfm, and the largest at 3600 cfm.

Three types of unit heaters are available: ceiling suspended downward discharge type with revolving discharge outlets for work areas; ceiling suspended, downward discharge type with stationary discharge outlets for storage areas; and horizontal discharge type with adjustable vanes for use where steam lines are not feasible, as relay stations, pump houses. The heaters can also be used for cooling purposes, in summer, with the heating element switched off and the fan on. L. J. Wing Mfg. Co.

14—MATHEMATICAL SERVICE

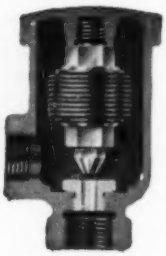
Is organized to find X for industrial plants, prepare charts, nomographs

This newly announced service devoted exclusively to applied mathematics is available to industrial plants desiring engineering calculations, complex charts and nomographs and the treatment of related problems. The organization is staffed by experts who specialize in the mathematical formulation and solution of problems from given physical data. Mathematical Computing Service.

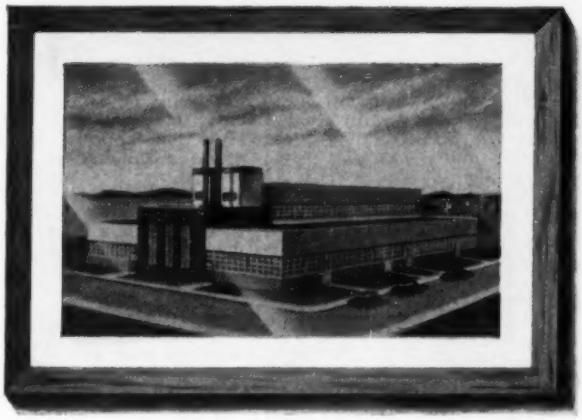
15—SMALL STEAM TRAP

For individual drainage of small pieces of steam using units

Smaller in size, capacity and price than this manufacturer's other types, the new Type D Thermostatic Bellows Steam Trap is suggested for use on tracer lines, unit heaters; kettles, steamers and similar equipment. It embodies several design improvements including generous sized hexagon shanks to accommodate standard wrenches, for installing or removing bellows and valve without throwing strain on the bellows element.



Other features announced include rugged internal guide rod and tube for maintaining alignment of valve and seat, and removable hardened steel valve and seat. Of bronze construction, the trap comes in ¼- to ¾-in. sizes in angle type only for pressures from vacuum to 200 lb. Bulletin 351 gives full data on the Type D trap. W. H. Nicholson & Co.



Whatever your fuel picture, *there's a B&O coal to fit it!*

• In the Baltimore & Ohio area lies a treasure-land of Bituminous—an almost inexhaustible source of low-cost heat and energy. Here are found Bituminous coals *of all varieties*—for power, for coking, for steam, for space heating.

B&O coals are excellent for generating steam in utility and industrial power plants, for steel mills, malleable iron plants, gas plants, lime and brick kilns, cement and glass plants, and potteries.

Whatever your "burning need," Industrial or Domestic, there's a B&O coal to meet it—and we are ready to help you find the best for your purpose. Just *ask our man!*

BITUMINOUS COALS FOR EVERY PURPOSE

LINKING 13 GREAT STATES WITH THE NATION ®

BALTIMORE & OHIO RAILROAD

Constantly *doing things*—better!

For more data circle 528 on Post Card

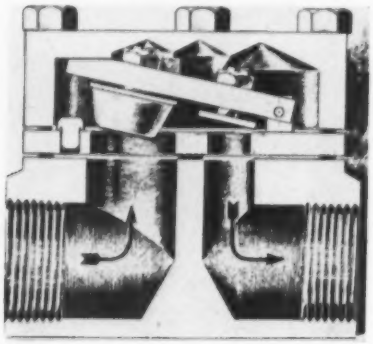
16—IMPULSE STEAM TRAP

Of high capacity, for handling large quantities of condensate

An important feature of the new Series 50 Yarway Impulse Steam Traps is ability to maintain high, even temperature in process equipment. Their small size and light weight make them particularly desirable where close-quarter piping is involved. The 1½-in. size, for example, is 5½ in. long, 5 in. high and 2⅝ in. wide, and weighs only 14½ lb. Made of stainless steel, they are designed to withstand difficult operating conditions.

These traps are said to be highly successful for condensate drainage on heat exchangers and stage heaters, reboilers, reheaters, stills, evaporators.

Basic operating principle is the same as that of company's well-known Series

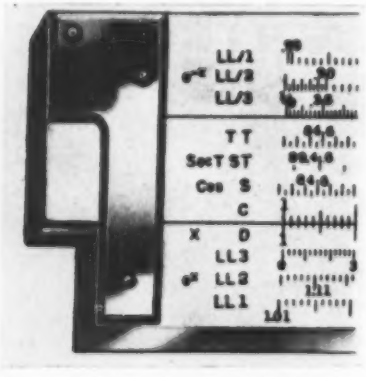


60 and 120 types. The Series 50 (shown in open position) employs a hinged lever and two valves mounted on a valve seat plate and the control flow which governs opening and closing action of the valve is obtained by allowing small clearance between inlet and outlet valves and their respective seats when the lever is at rest. Bulletin T-1745 gives full data on the traps. Yarnall-Waring Co.

17—SLIDE RULE

Features color coding to provide for greater accuracy

With the new Versalog Slide Rule for Professional Engineers, calculations involving trigonometric functions are performed without risk of errors by matching the color of the trig scale with the same color of the corresponding C, D, or



CI scale, it is pointed out. This mathematical compatability of the new color coding is designed to eliminate need for memorizing co functions.

Superiority of the rule is said to lie in the R_1 and R_2 scale combination, useful in computing quantities in which multiplication by the square of a number is involved. Other refinements of the rule are the new end zone designations of the log log reciprocal scales inscribed to the left of these scales and a more convenient arrangement and extension of the L L scales. An illustrated brochure is offered. Frederick Post Co.

18—HOLLOW TUBE TERMINAL

Is hermetically sealed, has extremely short extensions

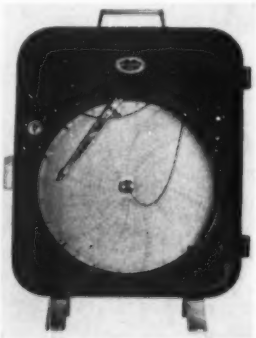
A new addition to this company's line of feed through terminals, this one's external extension is 5/32 in. and inside extension, ⅛ in. The hollow tube is permanently capped off by a welded lug to prevent accidental violation of the hermetic enclosure during attachment of external lead wires. The lug may be bent to any angle up to 90 deg depending on connection application. It is gas tight, company says, and capable of absorbing impact.

Amperage of the new terminal is determined by size of wire attached inside the hollow tube. This tube will accommodate any size wire up to 17 gage copper and wire can run the entire length of the tube. The terminal is made of glass and steel permanently interfused; it's attached by soft soldering. The Fusite Corp.

19—THERMOMETERS

For single- or double-pen recording; in three chart sizes

These compact, ruggedly built thermometers can be furnished in 8-, 10- and 12-in. chart sizes, for wall or flush mounting or portable use. Double-pen recorders are intended for applications



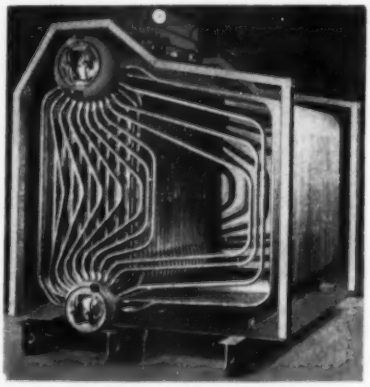
in which it is desired to record more than one temperature in a single process or operation on one chart, or where, because of space restrictions, a single chart is required for recording two temperatures in separate operations.

The thermometers are encased in cast aluminum. The stainless steel movement has a micrometer adjustment and is actuated by a stainless steel spiral spring. Hand wound or electric chart drives can be furnished for 12-hour, 24-hour and 7-day revolution. Weksler Thermometer Corp.

20—WATER TUBE BOILERS

Packaged type, for steam and high temperature hot water

This new standard line of boilers covers sizes ranging from 7500 to 30,000 lb of steam per hour (or equivalent water ratings) and design pressures of 200, 300, 600 and 900 psig. All are of two-drum bent tube design featuring a water cooled furnace in which tangent water tubes shield the full length combustion chamber. Large water capacity is credited with giving the boilers exceptional ability in handling heavy peak and



fluctuating loads. Provision for superheat up to 200 F is available as auxiliary equipment.

Firing is by oil or gas or combination burners. Units are offered with complete burner and control assembly or boiler can be purchased separately. The boilers are enclosed in an insulated steel jacket of sectional design and suitable for outdoor as well as indoor installation. Springfield Boiler Co.

21—TRANSMITTING DEVICE

Combines a pressure gage with a pneumatic transmitter

Output pressure of this transmitting instrument varies from 3 to 15 lb (or 5 to 25 lb if specified) regardless of the range of the pressure being measured. Company says high accuracy is achieved because the instrument is calibrated with comparison of actual pressure applied to the gage versus transmitted air.

Gages used are 6- or 8½-in. sizes with Bourdon springs available in a wide variety of materials. Ranges from vacuum to 10,000 psig are available. Extremely compact, this transmitting instrument takes up no more panel space than the gage itself. It is suitable for panel, pedestal or wall mounting. Bulletin 780 gives full information. Penn Industrial Instrument Corp.

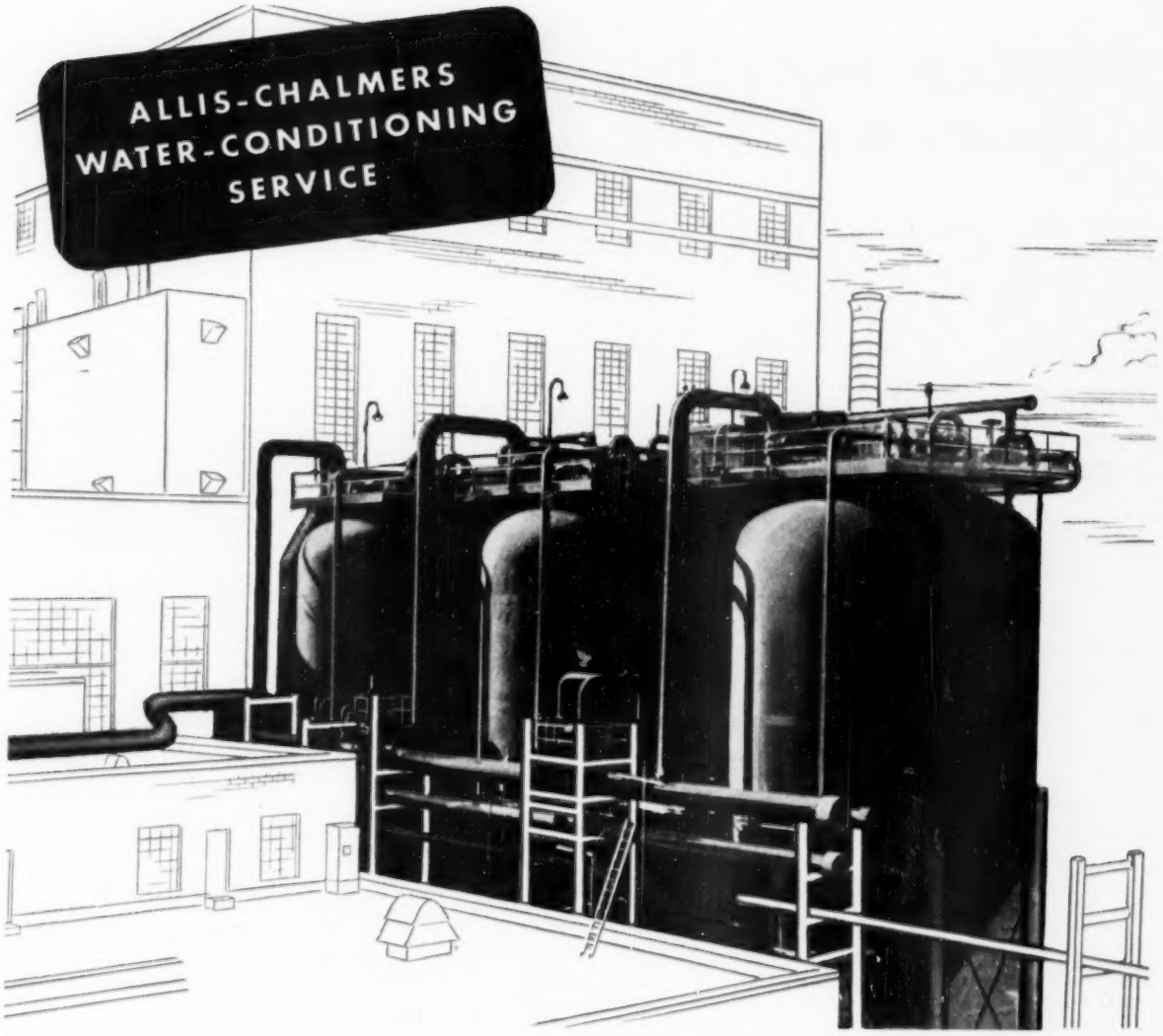
22—IMPEDANCE BRIDGE

Is battery-operated from a two-stage amplifier

The Universal Impedance Bridge, Model 250-C1, is designed for field use, but said to offer laboratory accuracy in the measurement of resistors, capacitors and inductors in signal, communication and power systems.

Battery operation is obtained from a two-stage amplifier, company's Model 850-B tuned to 1 kc. This unit is sold as an accessory. Brown Electro-Measurement Corp.

Want more details on these new products? Just circle the item numbers on post cards on pages 38 and 136



WATER HARDNESS CUT TO ZERO

at record rate of 240,000 gallons per hour!

THIS king-size, outdoor water-softening system was recently installed by Allis-Chalmers to meet the special needs of a leading midwest oil refinery. It furnishes four high-pressure boilers with filtered treated water at the extraordinary rate of 240,000 gallons per hour — the largest water-softening system ever installed in a refinery power plant.

Extremely rugged and designed for year-round operation outdoors, this Allis-Chalmers system has been in service about four years. There have been no breakdowns, and maintenance costs have been practically nil.

Whatever *your* industry—paper, petroleum, food, steel—you'll get prompt, convincing results with Allis-Chalmers Water Conditioning service.

For over 50 years Allis-Chalmers has been building power generation equipment. This experience is invaluable in providing our water conditioning specialists with the extensive background needed today to recommend correct equipment, chemicals and service.

An expert representative is available, ready to recommend proper chemicals or help select the right process for your power plant requirements. For complete information, contact your nearby Allis-Chalmers District Office, or write Allis-Chalmers, Milwaukee 1, Wis.

A-3916

ALLIS-CHALMERS

GENERAL MACHINERY DIVISION

MILWAUKEE, WIS. — PITTSBURGH, PA. — NORWOOD, OHIO — BOSTON, MASS. — TERRE HAUTE, IND. — MONTREAL, P. Q. — ST. THOMAS, ONT.

For more data circle 529 on Post Card

POWER PLANT *Construction News*

Gorgas, Ala. — Alabama Power Co., Alabama Power Bldg., Birmingham, Ala., has authorized construction of new steam-electric generating plant in vicinity of present stations at Gorgas. It will have an initial capacity of 150,000-kw., comprising a single turbine-generator of that rating, high-pressure boilers and auxiliary equipment. Plant will be designed to accommodate three additional units of same capacity at later date. Work on project is expected to begin soon, with completion in 1955. Cost estimated about $25,000,000.

Florence, Ariz. — Proven Oil & Refining Co., recently organized, care of Ebasco Services, Inc., 2 Rector St., New York, N. Y., engineer-contractor, plans power house at proposed new oil refining plant at Florence, where site has been selected. It will comprise a series of multi-story structures for fuel oils, gasoline and other refined petroleum products. Entire project is reported to cost about $18,000,000. Engineer noted will prepare plans and be in charge of construction.

Paragould, Ark. — Paragould Light Commission has plans under way for extensions and improvements in municipal oil-operated generating station, with installation of additional equipment. Cost estimated approximately $400,000, including extensions in distribution system. J. E. Flanders Co., Jefferson City, Mo., is consulting engineer.

El Centro, Calif. — Board of Directors, Imperial Irrigation District, El Centro, has authorized plans for new hydroelectric generating station at Pilot Knob, on All-American Canal, approximately 20 mi. below Imperial Dam. Cost reported about $6,500,000, including power dam, hydraulic turbines, electric generators and auxiliary equipment, with transmission line for connection with present system. Proposed to arrange bond issue to provide for project at early date. B. A. Weiss is executive engineer of District.

Norwalk, Conn. — Connecticut Light & Power Co., 36 Pearl St., Hartford, Conn., is considering new steam-electric generating station on Manresa Island, near Norwalk, where site is being selected. Details of project, including plant capacity, will be determined soon. Cost reported approximately $15,000,000, with transmission lines, power substations and other operating facilities.

Tampa, Fla. — U. S. Phosphoric Products Division, Tennessee Corp., Grant Bldg., Atlanta, Ga., plans boiler house at proposed new plant at East Tampa, for manufacture of nitrophosphate fertilizers. It will comprise several buildings for processing and general production. Cost reported about $1,400,000.

Chicago, Ill. — Commonwealth Edison Co., 72 West Adams St., has arranged an expansion and improvement program to be carried out over next 48 mos., 1953–1956, inclusive, to cost about $500,000,000, including additional generating facilities, power substations, transmission lines and other operating equipment.

Lockport, Ill. — Public Service Co. of Northern Illinois, 72 West Adams St., Chicago, Ill., has plans maturing for new steam-electric generating plant in vicinity of Lockport, to be known as generating station No. 8. It will be multi-story, about 200 x 200 ft., equipped for large capacity. Work on substructure is scheduled to begin early in 1953. Cost reported about $60,000,000, including widening of canal, dock structure and other auxiliary construction. Sargent & Lundy, Inc., 140 South Dearborn St., Chicago, is consulting engineer.

Crawfordsville, Ind. — Electric Light & Power Dept. plans extensions and improvements in steam-electric municipal power plant, including construction of addition to present station, installation of new 11,500-kw. turbine-generator, boiler and auxiliary equipment. Cost estimated about $2,250,000. Proposed to begin work soon.

Jasper, Ind. — Municipal Light & Water Dept. has plans under way for extensions and improvements in municipal steam-electric generating plant, with installation of new turbine-generator, boilers and auxiliary equipment. Cost reported about $2,500,000. Stanley Engineering Co., Muscatine, Iowa, is consulting engineer.

Davenport, Iowa — Aluminum Co. of America, Gulf Bldg., Pittsburgh, Pa., plans power house at proposed new aluminum rolling mill at Davenport, where site has been selected. It will comprise a number of units and is estimated to cost about $6,500,000.

Kansas City, Kan. — Board of Public Utilities, 6th St. and Ann Ave., has plans for new municipal steam-electric generating station, reported to cost approximately $20,000,000, with turbine-generators, high-pressure boilers and auxilary equipment. Work is scheduled to begin early in 1953. Burns & McDonnell Engineering Co., 95th and Troost Sts., Kansas City, Mo., is consulting engineer.

Louisville, Ky. — General Mills, Inc., 400 Second Ave., South, Minneapolis, Minn., flour, animal feeds, cereal products, etc., plans boiler plant at proposed new flour blending mill at Louisville, where site is being selected. It will consist of a main multi-story structure for compounding and general production, and several auxiliary structures. No official estimate of cost announced — reported in excess of $1,000,000.

New Iberia, La. — Richardson Co., Lake and 26th Sts., Melrose Park, Chicago, Ill., plastic products, plans boiler house at proposed new branch plant at New Iberia, comprising a main one-story building, 150 x 200 ft., for general production, and several smaller structures. Cost reported close to $1,000,000. Work will be placed under way soon.

Shreveport, La. — Southwestern Gas & Electric Co., Shreveport, plans new steam-electric generating plant on Wallace Lake, with turbine-generator, high-pressure boiler and auxiliary equipment for sizable output. Details are now being determined. Cost reported about $8,000,000. It is understood that plans will be prepared by Sargent & Lundy, Inc., 140 South Dearborn St., Chicago, Ill., consulting engineer.

St. Louis, Mo. — Huttig Sash & Door Co., 1218 South Vandeventer Ave., plans boiler house at proposed new millwork plant on 14-acre tract of land in Pagedale district, near city. It will consist of several one-story buildings, totaling about 140,000 sq. ft. floor space. Cost estimated about $1,000,000. Proposed to begin work early in 1953.

Butte, Mont. — Montana Power Co., 40 East Broadway, is arranging an expansion and improvement program for a 24-mo. period, 1953 and '54, to cost about $27,000,000. A primary feature of project will be the installation of a third generatering unit at Kerr hydroelectric power development, near Polson, Mont. Other work will include transmission lines, power substations and other operating facilities.

Omaha, Neb. — Omaha Public Power District, 17th and Harney Sts., plans new addition to local power plant, with installation of additional equipment for increased capacity. Cost reported in excess of $800,000. A. G. Johnson is chief engineer.

Littleton, N. H. — Connecticut River Power Co. has plans nearing completion and will begin work in spring of 1953 on new hydroelectric generating plant at 15-Mile Falls on Connecticut River, near Littleton. Project will include a power dam, 180 ft. high and 2900 ft. long, creating a lake 11 mi. long. Plant will be equipped for a rated capacity of 150,000-kw. and will require about 3½ yrs. for completion. Cost is estimated at $50,000,000.

Nyack, N. Y. — Rockland Light & Power Co., Nyack, is arranging an expansion and improvement program in plants and system to be carried out during next 48 mos., 1953–1956, inclusive, to cost approximately $36,000,000, including increased generating capacity, power substations, transmission lines and other operating facilities.

Akron, Ohio — Ohio Edison Co., Akron, is arranging financing in amount of about $30,000,000, proceeds to be used for 1953 expansion and improvement program, including additional generating capacity, power substations, transmission lines and other operating facilities.

Durant, Okla. — Hale-Halsell Co., McAlester, Okla., prepared foods, plans boiler house at proposed new food-processing plant at Durant. It will comprise a main one- and two-story buildings for general manufacture. Cost reported about $500,000. Work will begin soon.

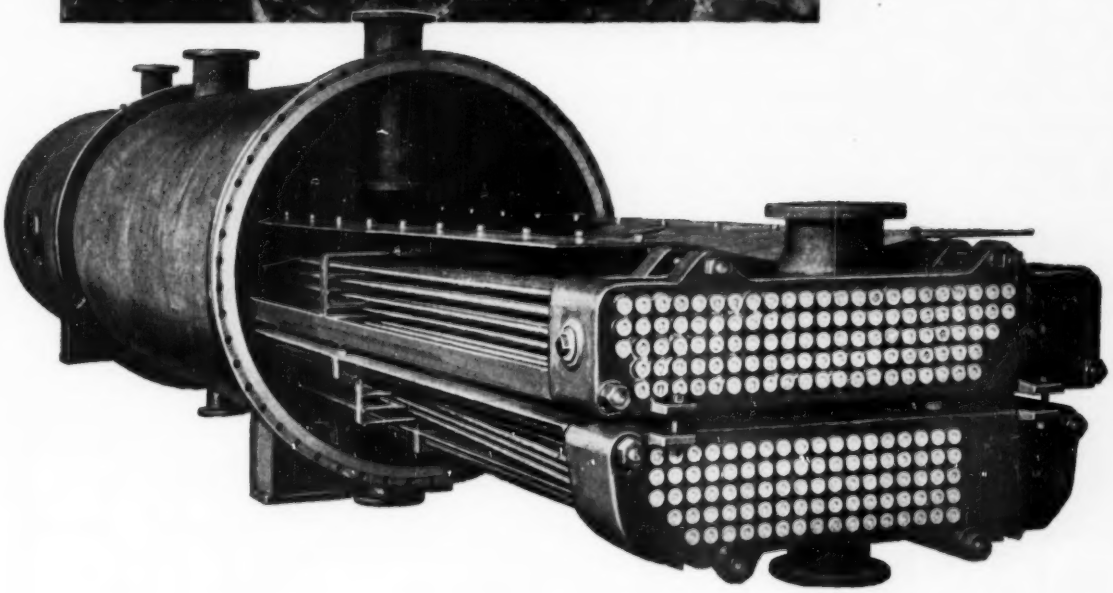
Ponca City, Okla. — Municipal Water & Light Dept. will make extensions and improvements in municipal power plant, with installation of additional equipment for increased capacity. Cost reported about $550,000. A bond issue has been approved in that amount and work is expected to begin at early date. C. E. Norton is engineer.

Hollidaysburg, Pa. — Pennsylvania Railroad Co., Pennsylvania Terminal, Philadelphia, Pa., plans boiler house at proposed new freight car repair shop at Hollidaysburg, where site has been selected. It will comprise a number of buildings, and is estimated to cost $12,000,000, with equipment. Completion is scheduled in 1954. Company engineering department is in charge.

Garfield, Utah — Western Phosphates, Inc., 700 Pacific National Life Bldg., Salt Lake City, Utah, plans power house at new plant at Garfield, for production of phosphates for fertilizer service. It will comprise several buildings, equipped for output of about 75,000 tons per annum. Work will be placed under way at early date.

Hopewell, Va. — Allied Dye & Chemical Corp., 61 Broadway, New York, N. Y., plans power house at proposed new mill near Hopewell, for manufacture of synthetic fibre products, comprising several one- and multi-story buildings for processing and general production. Tract of 600 acres of land has been purchased, with frontage on James River. Proposed to begin work in 1953. Cost reported about $23,000,000.

SCALE...
no problem in this Evaporator



There's never a need to chisel scales from the tubes of a G-R Bentube Evaporator, no matter how hard your raw water supply may be.

You'll always be free from that chore, because this evaporator sheds scale *automatically* . . . with each change in temperature of its exclusive Bentube elements.

And these units have many additional distinctive features that assure pure dry vapor, minimum steam pressure drop, and special maintenance conveniences.

The definite Bentube Evaporator guarantees of vapor capacity and extreme purity are based on the unequalled G-R experience of more than 50 years in building evaporators for central power generating stations, industrial plants and vessels of every type.

Write for bulletin describing these units in detail.

THE GRISCOM-RUSSELL CO., MASSILLON, OHIO

G-R HEAT TRANSFER APPARATUS **Bentube Evaporators**

GR 298

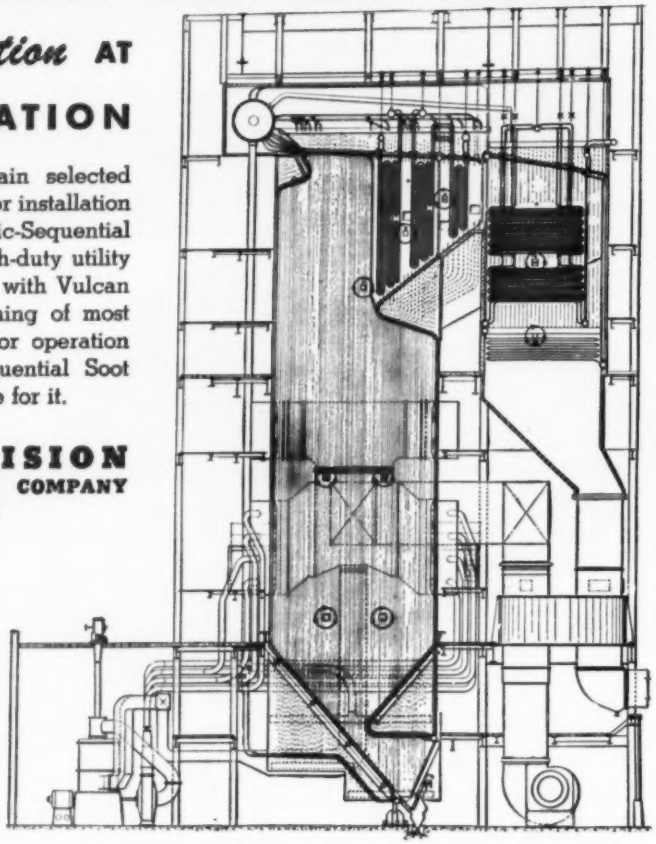
For more data circle 530 on Post Card

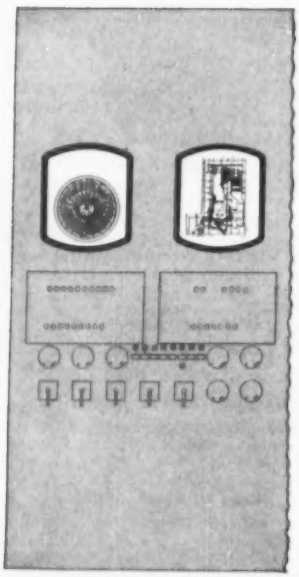
5th VULCAN System for LONG ISLAND LIGHTING COMPANY

An Outdoor Installation AT FAR ROCKAWAY STATION

Long Island Lighting Company has again selected Vulcan Automatics—this time for an outdoor installation at Far Rockaway—the fifth Vulcan Automatic-Sequential System for this utility. More and more high-duty utility and industrial boilers are being equipped with Vulcan Automatics. The reason is effective cleaning of most difficult locations, with minimized costs for operation and maintenance. Vulcan Automatic-Sequential Soot Blowing is described in Bulletin 483. Write for it.

COPES-VULCAN DIVISION
CONTINENTAL FOUNDRY & MACHINE COMPANY
ERIE, PENNSYLVANIA



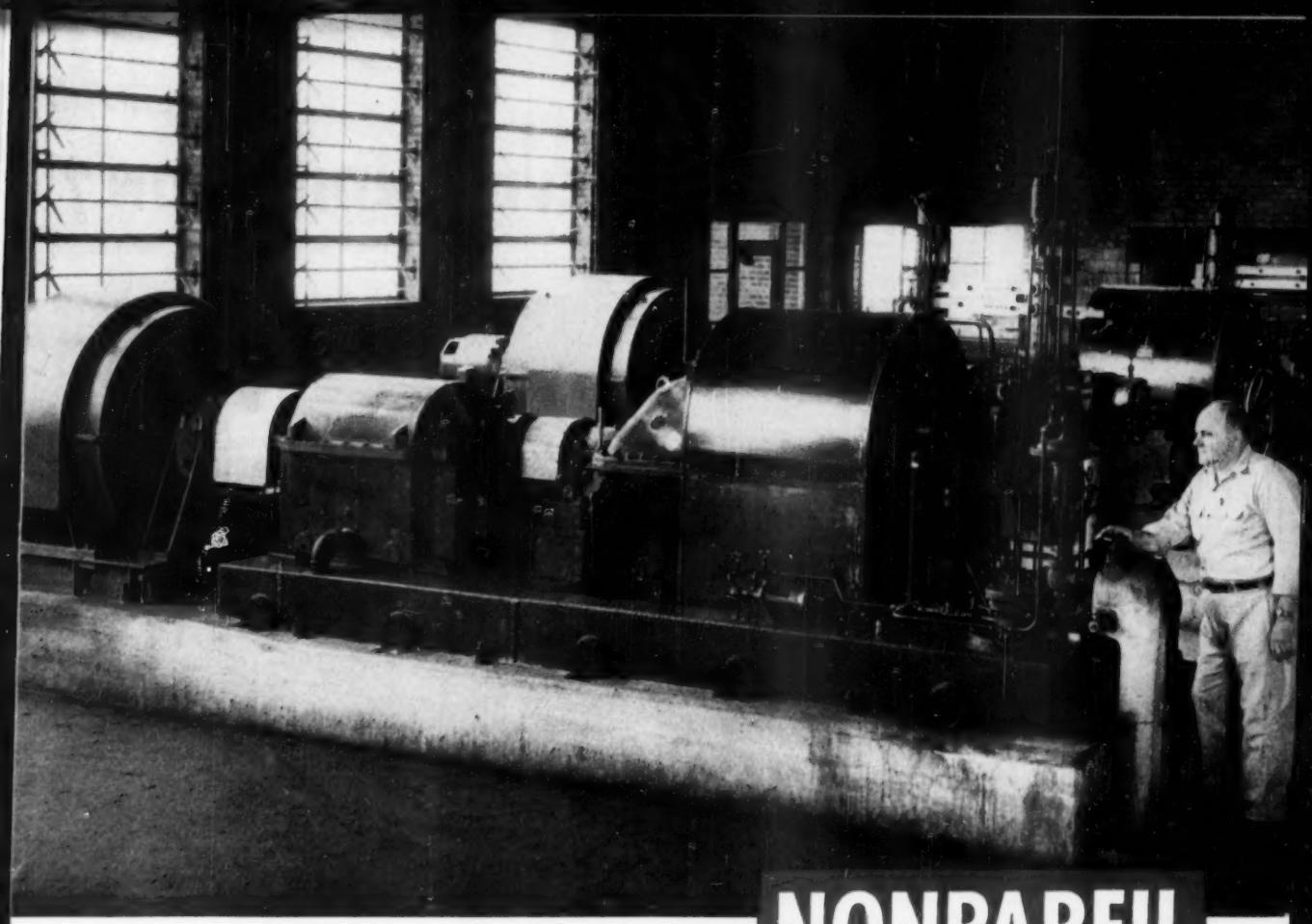


Standing at this panel, the operator can start the blowing cycle, observe proper operation of each blower, see the system shut off automatically when the cycle is complete. He can also cut one or more blowers out of sequence, or repeat blower operation at any location.

Steam Generator.....Radiant-Reheat Type; Combustion Engineering-Superheater, Inc.
Capacity.....750,000 lb per hr
Throttle Pressure.....1450 psig
Primary Steam Temperature.....1005 F
Reheat to.....1005 F
Fired by.....Pulverized coal, oil, natural gas
Soot Blowing. Vulcan Automatic Sequential System, including necessary wall blowers, long retractables and controls for air-heater cleaners. All driven by, and blow with, air.
Consulting Engineers.....Ebasco Services, Inc.

VULCAN *Automatic Soot* **BLOWERS**

For more data circle 531 on Post Card



Turbine oil systems stay clean with...

NONPAREIL
TRADE MARK
Turbine Oil

• When the two turbines shown above were installed in a large Milwaukee tannery, they were filled with NONPAREIL Turbine Oil. NONPAREIL lubricates each turbine and its reduction gear unit from one oil reservoir.

During nearly two years' operation, the original fills of NONPAREIL were not removed from the turbines either to clean the oil systems or to treat the oil. Neutralization numbers stayed below 0.04 mg. KOH/gm. Recently, plant officials and a representative of the turbine manufacturer made a thorough inspection of the turbines' lubricating systems. They found gears and bearings in excellent condition. They found no appreciable deposits either in the turbine oil or in the lubricating systems. The turbine manufacturer's representative expressed approval of the job being done by NONPAREIL Turbine Oil.

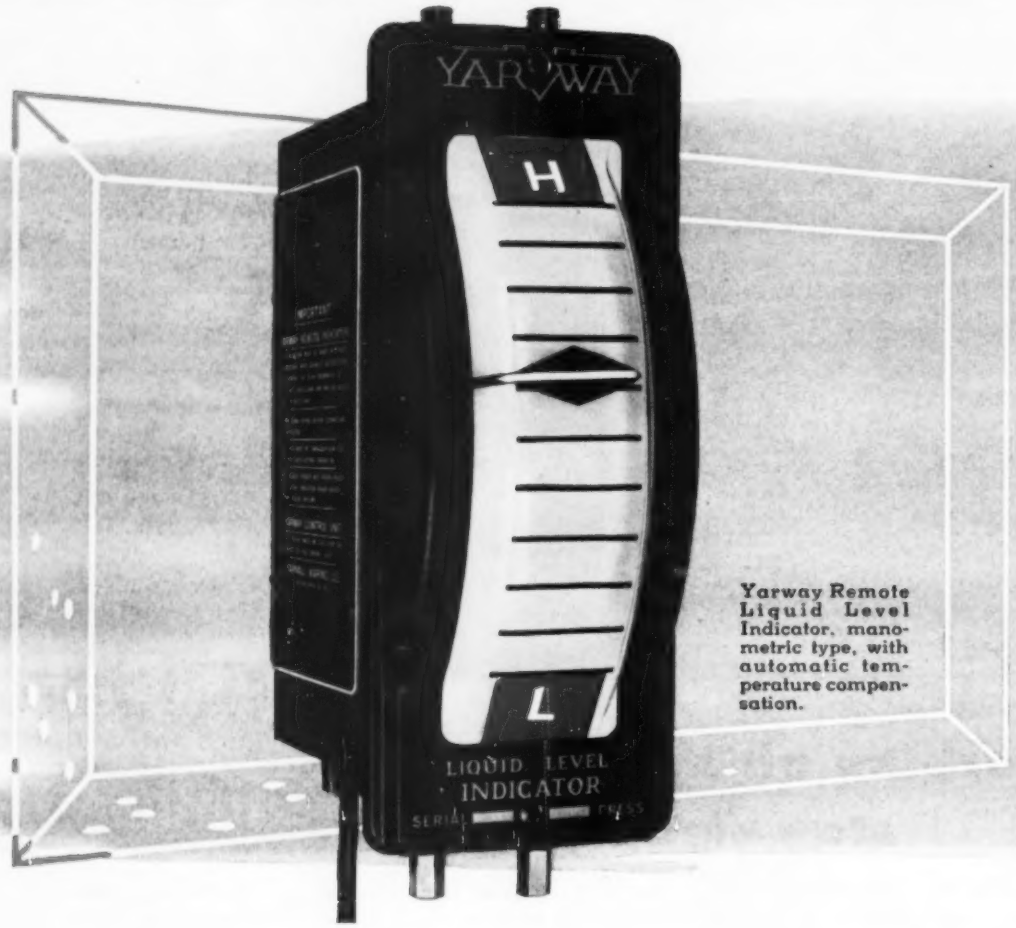
Through the use of NONPAREIL, officials of this Milwaukee tannery are assured of clean, trouble-free lubrication for the *life* of their turbines. This assurance is based on the written guarantee, given with each fill of NONPAREIL, that this outstanding lubricant will last for the *life* of the turbine it lubricates and that it will maintain a neutralization number below 0.15 mg. KOH/gm.

The Standard Oil lubrication specialist in your section of the Midwest will be glad to tell you about NONPAREIL's written guarantee. He will show you NONPAREIL operating records that cover up to 25 years' service in a single turbine. You can contact this lubrication specialist by phoning your local Standard Oil office. Or write, Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois.

STANDARD OIL COMPANY

STANDARD *(Indiana)*

What's New
IN BOILER WATER LEVEL INDICATION?



Yarway Remote Liquid Level Indicator, manometric type, with automatic temperature compensation.

IMPROVED *WIDE VISION* REMOTE LIQUID LEVEL INDICATOR

A new-type face on the Yarway Remote Liquid Level Indicator now permits side as well as head-on dial readings. This vastly improved visibility makes it possible to check boiler water levels from most any position in the control room, or wherever the Yarway Remote Indicator may be installed.

MANOMETRIC TYPE

The Yarway Indicator is a manometric type with automatic temperature compensation. Level readings are instant and accurate because the indicator is operated by the boiler water itself. The indicating mechanism is never under pressure. There are no stuffing boxes.

Over 8,000 Yarway Remote Liquid Level Indicators are successfully operating throughout industry—primarily for indicating boiler water levels, but also for many other liquid level applications, and for superheater pressure differential indication aboard ship.

For full information on Yarway Indicators, write for Yarway Bulletin WG-1823.

YARNALL-WARING COMPANY · 114 Mermaid Avenue, Philadelphia 18, Penna.

YARWAY *STEAM PLANT EQUIPMENT*

For more data circle 533 on Post Card

Here and There

With The Editors

AT J. I. Case Co. in Racine, Wisconsin, we called recently on Cole Morrow, plant engineer for all the plants of his company, and were given the $100 tour . . . Found he does some very interesting things . . . Here are some:

1 — Has some original ideas for eliminating soot blowing . . . Has proof too.

2 — Is installing a marine turbine-generator set . . . Was told he couldn't do it — but he is!

3 — Has a wonderful maintenance crew. They do all types of work — build buildings, weld pipe, do steam fitting, repair equipment. No outside contractors of any kind are called in.

4 — Runs training school for their power and plant engineers . . . The young men are given problems to do, such as building a new boiler . . . They design all parts, write all specifications, survey the site, help build and assemble, start the boiler themselves and run it for several months after . . . It is their baby from start to finish . . . If it doesn't work properly, it is their own fault and they've got to make it work right . . . If OK — feathers in their caps.

5 — Believes the human factor should be eliminated wherever possible around a power station . . . Thus, he and his men design control systems first, to do what must be done, and then try to make the controlled equipment do what the controls command.

★ ★ ★

IN OUR SPECIAL report on the POWER ENGINEERING Week in New York, January issue, we feel that we did not sufficiently express our deep appreciation to some of those who helped so greatly to make POWER ENGINEERING'S own exhibit in Booth 12 at the Power Show a success. It was so attested by the hundreds of POWER ENGINEERING'S readers and friends who called there.

First of all, our heartiest thanks are due The Detroit Edison Co., which supplied the complete model of its new St. Clair plant, now under construction, shipping it in carefully crated sections from Detroit to New York and back again for the sole purpose of allowing us to have a model of an important new station for Power Show visitors to study.

Second, our heartiest thanks to George Clark, chief engineer of Paine Lumber Co. Ltd. of Oshkosh, Wisconsin, who built and lent to us the model of the Hero turbine shown here, for display in our booth. We tried at first to operate the model on bottled nitrogen, very generously supplied to us in flasks by the Linde Air Products Company. However, through no fault of Linde's, this didn't work out very well and we were much chagrined when Mr. Clark himself, accompanied by Mrs. Clark, appeared at Booth 12 the first day when we could not make his model run.

We then obtained a little 3-cfm Pioneer air compressor and the model ran perfectly on compressed air for the rest of the week. When the picture was taken, the little turbine was operating at about 75 rpm but the photographer "froze" it.

Detroit Edison Co.'s St. Clair Station model, set up in POWER ENGINEERING'S *Power Show booth, showed the station itself, coal storage, switchyard and details*

Here is the way George Clark's model of the Hero Turbine was shown in POWER ENGINEERING'S *booth at the 20th National Power Show in New York. Speed, 75 rpm*

★ ★ ★

DURING OUR TRIP EAST *to the Power Show, we also found a little time to call at several of the new central stations. One of these was the Salem Harbor Station of New England Electric System at Salem, Massachusetts.*

You have seen pictures of it in the News Reel but they cannot do justice to its fine appearance, especially when seen, as we saw it, on a sparkling-cold, clear November day, with a fresh sea breeze blowing in across the harbor.

Superintendent Frank E. Bell was away on his vacation the day we were there and J. F. Kenney, field representative of New England Power Service Company was in charge. Mr. Kenney was construction superintendent of the station for N.E.P.S. Co., working with United Engineers and Constructors. Hence he knew every bolt and nut and weld in it, as we realized as soon as he began to show us around.

Inside, the station is as beautiful and well arranged as it is outside. Two 75,000 kw (nominal) turbine generators were carrying full load.

From the roof, we had a magnificent panorama of the harbor, with Essex, Manchester, Gloucester on one side, Peach's Point and part of Marblehead on the other. The sea breeze and the view recalled days of our youth, when we sailed those waters.

For some strange reason, two apparently insignificant details stuck in our mind: 1, a spray for breaking up foam in the condenser circulating water in the discharge channel to the harbor; 2, a detergent tray in the very fine "crew's" quarters, built right into the shower doorway so you can't get in or out of the shower without stepping in the detergent.

Yet — it is exactly that sort of detail that bespeaks good design and careful attention to other details of a station.

★ ★ ★

Stopped in recently at the Schlitz Brewing Co., in Milwaukee, to see their new power station and meet Bob Nicoli, Power Engineer . . . The fact that the station was connected with a brewery had no bearing on the fact that we stopped there. . . . Of course it didn't!

The power plant is very neat and orderly . . . They are generating most of their company's power requirements, and when the new Allis-Chalmers turbine-generator they are now installing is put into operation, they will be generating all of it . . .

Will Your Extraction Turbine Use Process Steam Economically?

To help you calculate the amount of process steam to or from your multiple automatic-extraction steam turbines, here are three step-by-step examples—high pressure, low pressure and double extraction

By E. V. POLLARD

Section Engineer
Turbine Engineering Division
General Electric Co.

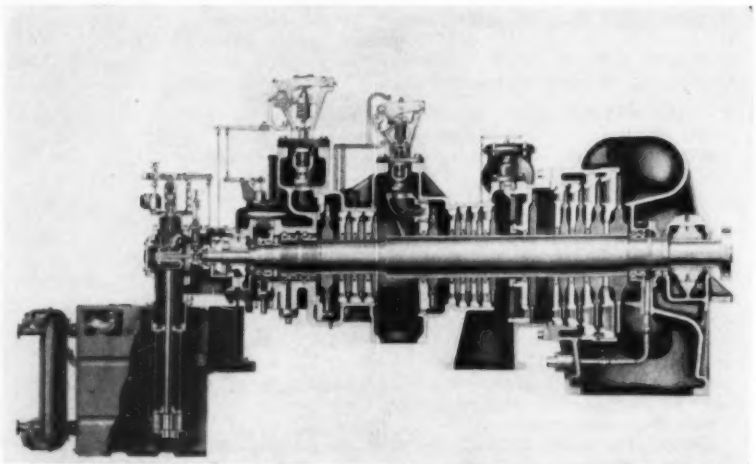


Fig. 1. Cross-section of a steam turbine showing typical double-automatic-extraction design features

IS A PROPOSED multiple automatic-extraction steam turbine generator large enough to economically use the process steam requirements?

Conventional performance curve for such a steam turbine generator, Fig. 2, does not adequately show outputs available with various combinations of process flows.

Figure 2 may be constructed from data given in this article. This data has been greatly abbreviated due to space limitations; necessarily it is somewhat approximate.

General expression for throttle flow at a given load with double automatic extraction or admission is:

$$F_T = F_o + (F_H \times f_H) + (F_L \times f_L) \quad (a)$$

Also, $F_T = + F_H + F_L + F_o$ (b)

The following nomenclature will be used:

F_T = throttle flow, lb per hr
F_H = high-pressure extraction or admission flow, lb per hr
F_L = low-pressure extraction or admission flow, lb per hr
F_o = non-extraction flow at a given load, lb per hr
F_I = flow to intermediate section, lb per hr
F_c = flow to exhaust, lb per hr
f_H = high-pressure extraction or admission factor
f_L = low-pressure extraction or admission factor.

In case a manufacturer's performance curve similar to Fig. 2 is at hand, the given data (Tables I to IV inclusive and Figs. 6 and 7) would not be used; rather data for calculating the information for plotting Figs. 3, 4 and 5 should be derived from Fig. 2.

For instance, the non-extraction flow at a given load is read from the low-pressure zero extraction curve in the right-hand section of Fig. 2. The maximum and minimum section flows are given.

Extraction or admission factor data at either extraction pressure are found as follows:

Assume zero extraction or admission at the other pressure and read all data on vertical lines.

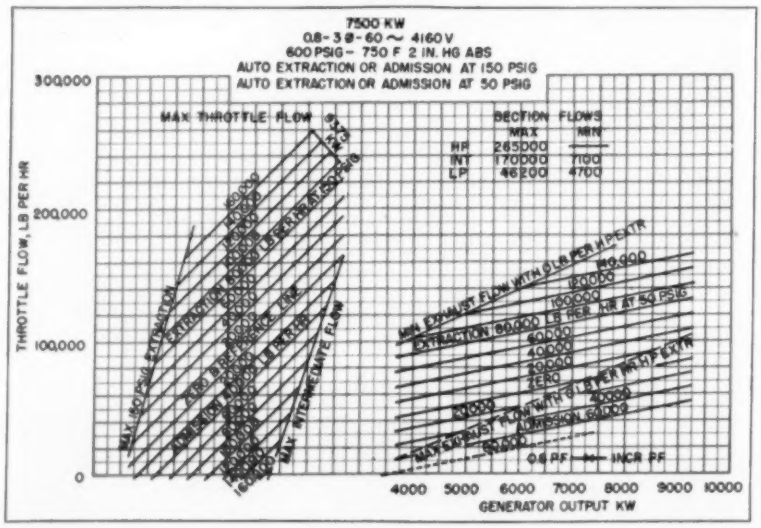
Extraction factor,

$$f = \frac{(F_T \text{ at X lb per hr extraction}) - (F_T \text{ at 0 lb per hr extraction})}{(\text{X lb per hr extraction})}$$

Admission factor,

$$f = \frac{(F_T \text{ at 0 lb per hr admission}) - (F_T \text{ at Y lb per admission})}{(\text{Y lb per hr admission})}$$

Fig. 2. A conventional performance curve for a multiple automatic-extraction steam turbine generator



EXAMPLE 1 — High Pressure Extraction, Low Pressure Admission, Maximum Flow to Exhaust

Rating: 7500 kw, 0.8 pf, 9375 kva, 60 cycle

Steam Conditions:

Throttle 600 psig, 750F (261F Superheat)

Exhaust 2 in. Hg abs. TSR_1 = 7.09 lb per kwh

High pressure extraction 150 psig TSR_2 = 23.83 lb per kwh

Low-pressure admission 50 psig TSR_3 = 15.36 lb per kwh

Design Extraction Flows:

High-pressure 160,000 lb per hr

Low-pressure 140,000 lb per hr

Full Load Non-Extraction Flow (In this case, also maximum flow to exhaust, Fc):

$$4/4\ L\ F_o = \frac{(TSR_1)\ (\text{Full Load, kw})}{\underset{\text{(Base Eff.) Table 1}}{0.685} \times \underset{\text{(Superheat Corr.) Table 2}}{1.011} \times \underset{\text{(Back Pressure Corr.) Table 3}}{1.008}} = \frac{7.09 \times 7500}{0.685 \times 1.011 \times 1.008} = 76{,}200 \text{ lb per hr}$$

$$\frac{TSR_1}{TSR_2} = \frac{7.09}{23.83} = 0.297,\ f_H = 0.728 \text{ (Fig. 6)},\qquad 1 - f_H = 0.272,$$

$$\frac{TSR_1}{TSR_3} = \frac{7.09}{15.36} = 0.462,\ f_L = 0.522 = 0.562 \times 0.93 \text{ (Fig. 6)},\quad 1 - f_L = 0.478,\ \frac{(1-f_H)}{(1-f_L)} = 0.569$$

(1)	(2)	(3)	(4)	(5)
KW	Table 4 Non. Extr. Load Factor	$4/4\ LF_o \times$ (2) F_o	(3) − 76200 $F_o - F_c$	(4) ÷ 0.478 $\frac{F_c - F_o}{1 - f_L}$
3750	0.62	47,200	29,000	60,700
5625	0.81	61,700	14,500	30,300
7500	1.00	76,200	0	0
9375	1.19	**90,700	− 14,500	− 30,300

(**For calculation purposes only.)

(6) Load	3750	3750	5625	5625	7500	7500	9375	9375
(7) F_H, HP Extraction Flow, (Assume)	0	30000	30000	60000	50000	100000	60000	100000
(8) $F_H\ (1 - f_H)$, (7) × 0.569 $\frac{}{(1 - f_L)}$	0	17070	17070	34150	28450	56900	34150	56900
(9) $F_c - F_o$, column (5) at load $(1 - f_L)$	60700	60700	30300	30300	0	0	− 30300	− 30300
(10) F_L, LP admission flow, (8) + (9)	60700	77770	47370	64450	28450	56900	3850	26600

Plot line (7) vs line (10) on Fig. 4.

Maximum 50 psig admission must not exceed maximum flow to exhaust minus minimum intermediate section flow; the latter is read on Fig. 7 at rating and high pressure extraction pressure.

Max. F_L = 76,200 − 7100 = 69,100 lb per hr.

The maximum 150 psig extraction flow is limited to the given value of 160,000 lb per hr.

Now assume that performance chart, Fig. 2, is not available.

Example 1

At a given load, the greatest amount of low-pressure steam can be admitted when the exhaust section is passing its maximum flow and the intermediate section its minimum flow.

Example 1 is a step method for calculating the low-pressure admission flow at a given load with maximum flow to exhaust.

It is a solution of the equation,

$$F_L = F_H \frac{(1 - f_H)}{(1 - f_L)} + \frac{(F_c - F_o)}{(1 - f_L)} \qquad (c)$$

Equation (c) is a rearrangement of,

$$F_c = F_o + (F_H \times f_H) - (F_L \times f_L) - F_H + F_L \qquad (d)$$

Table I. Base full-load non-extraction efficiencies for condensing double-automatic extraction steam turbines at 200 F superheat and 1.5-in. mercury

Rating, in kw at 0.8 pf	Main Pressure, psig 400	600	850	1250	1450
	Efficiency, Fraction				
2000	0.636	0.620			
2500	0.648	0.634			
3000	0.657	0.644	0.633		
3500	0.665	0.653	0.643		
4000	0.672	0.660	0.650		
5000	0.680	0.669	0.660		
6000	0.688	0.677	0.669		
7500	0.695	0.685	0.677		
10000	0.703	0.695	0.688	0.681	0.678
12500	0.709	0.702	0.695	0.689	0.686

Table II. Correction to efficiency for superheat

Superheat, F	Efficiency Factor	Superheat, F	Efficiency Factor
150	0.990	300	1.017
175	0.995	325	1.020
200	1.000	350	1.024
225	1.004	375	1.028
250	1.009	400	1.030
275	1.013	425	1.034

Table III. Correction to efficiency, back pressure

Design Back Pressure, in Hg abs.	Efficiency Factor
1.00	0.980
1.25	0.992
1.50	1.000
1.75	1.005
2.00	1.008
2.25 and above	1.010

Table IV. Non-extraction flow factor/per cent load

Load, %	Non-Extraction Flow Factor
50	0.62
75	0.81
100	1.00
125	**1.19

** For calculation purposes only.

Fig. 3. Simultaneous extraction flows, minimum to exhaust. Automatic extraction, 150 and 50 psig

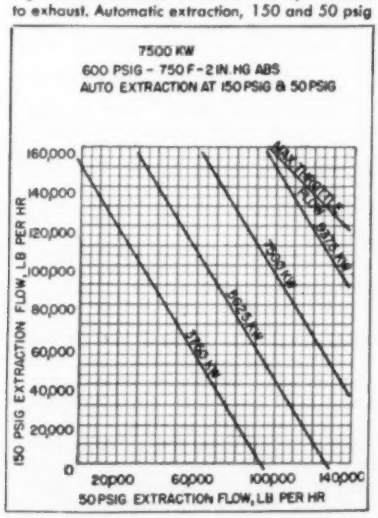


Fig. 4. Simultaneous 150-psig extraction and 50-psig admission flow with maximum flow to exhaust

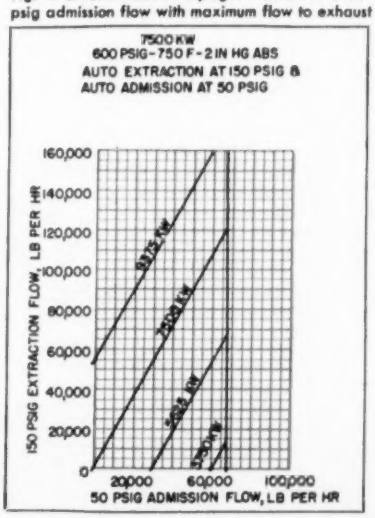
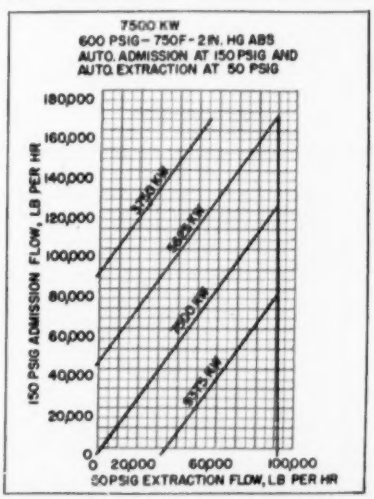


Fig. 5. Simultaneous 150-psig admission and 50-psig extraction flow with maximum flow to exhaust



Note that f_H is high-pressure extraction factor and f_L is low-pressure admission factor.

In Example 1, F_o is the maximum flow to exhaust without a pressure rise and is equal to the non-extraction throttle flow at 7500-kw load.

The maximum 50-psig admission flow, on Fig. 4, is equal to the maximum exhaust flow minus the minimum intermediate section flow, from Fig. 7, at 150 psig.

Example 2

The simultaneous extraction flows with minimum flow to exhaust at definite loads are required in order that the output from process steam only may be found for a range of process flows. This information at several initial steam conditions should be used to evaluate the initial pressure and temperature that is selected.

Example 2 is a step method for calculating the simultaneous extraction flows at a given load.

It is a solution of the equation,

$$F_L = \frac{(F_o - F_e)}{(1 - f_L)} - \frac{F_H\,(1 - f_H)}{(1 - f_L)} \qquad (e)$$

Equation (e) is the simultaneous solution of equations (a) and (b) when,

(a) $= F_T = F_e + (F_H \times f_H) + (F_L \times f_L)$ and

(b) $= F_T = F_H + F_L + F_e$

Note that f_H and f_L are high-pressure and low-pressure extraction factors, respectively.

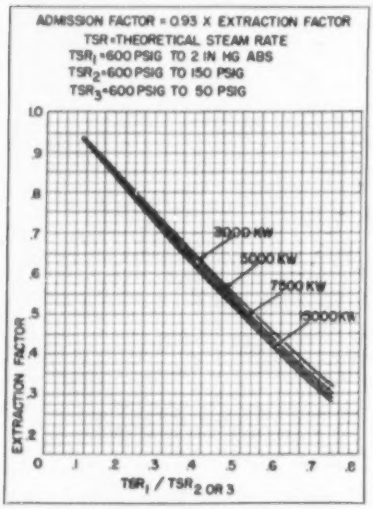
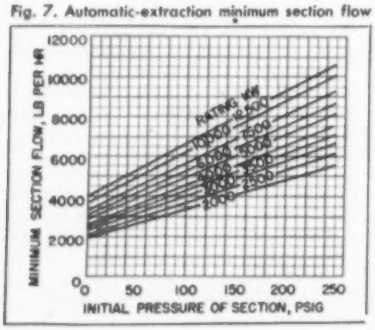


Fig. 6. The extraction factor for different ratings

Fig. 7. Automatic-extraction minimum section flow



EXAMPLE 2—Double Extraction With Minimum Flow To Exhaust

Same Rating, Steam Conditions and Extraction Flows as in Example 1.

Full Load Non-Extraction Flow:

$$4/4\,LF_o = \frac{(TSR_1)\ 7.09 \times (\text{Full Load, kw})\ 7500}{0.685\ (\text{Base Eff.})\ \text{Table 1} \times 1.011\ (\text{Superheat Corr.})\ \text{Table 2} \times 1.008\ (\text{Back Pressure Corr.})\ \text{Table 3}} = 76{,}200 \text{ lb per hr}$$

Cooling steam flow, Fig. 7 = 4700 lb per hr.

$\frac{TSR_1}{TSR_2} = \frac{7.09}{23.83} = 0.297$, $f_H = 0.728$ (Fig. 6), $\quad 1 - f_H = 0.272$,

$\frac{TSR_1}{TSR_3} = \frac{7.09}{15.36} = 0.462$, $f_L = 0.562$ (Fig. 6), $\quad 1 - f_L = 0.438$, $\frac{1 - f_H}{1 - f_L} = 0.621$

(1) KW	(2) Table 4 Non-Extr. Load Factor	(3) $4/4\,LF_o \times$ (2) F_o	(4) (3) − 4700 $F_o - F_e$	(5) (4) ÷ 0.438 $\frac{F_o - F_e}{1 - f_L}$
3750	0.62	47,200	42,500	97,000
5625	0.81	61,700	57,000	130,100
7500	1.00	76,200	71,500	163,200
9375	1.19	**90,700	86,000	196,400

(**For calculation purposes only.)

(6) Load	3750	3750	5625	5625	7500	7500	9375	9375
(7) F_H, HP Extraction Flow, (Assume)	60000	120000	80000	160000	80000	160000	100000	160000
(8) $F_o - F_e$ column (5) at load $1 - f_L$	97000	97000	130100	130100	163200	163200	196400	196400
(9) $F_H \frac{(1 - f_H)}{(1 - f_L)}$, (7) × 0.621	37300	74500	49700	99400	49700	99400	62100	99400
(10) F_L, LP Extraction Flow (8) − (9)	59700	22500	80400	30700	113500	63800	134300	97000

Plot line (7) vs. line (10) on Fig. 3.

The "Maximum Throttle Flow" line on Fig. 3 is plotted at $F_H + F_L = 260{,}300 = 265{,}000 - 4700$

EXAMPLE 3—High Pressure Admission, Low Pressure Extraction, Maximum Flow To Exhaust

Same Rating, Steam Conditions and Extraction Flows as in Example 1:

Full Load Non-Extraction Flow (In this case, also maximum flow to exhaust, F_o.)

$$4/4\,L\,F_o = \frac{(TSR_1)\ 7.09 \times (\text{Full Load, kw})\ 7500}{0.685\ (\text{Base eff.})\ \text{Table 1} \times 1.011\ (\text{Superheat Corr.})\ \text{Table 2} \times 1.008\ (\text{Back Pressure Corr.})\ \text{Table 3}} = 76{,}200 \text{ lb per hr}$$

$\frac{TSR_1}{TSR_2} = \frac{7.09}{23.83} = 0.297$, $f_H = 0.677 = 0.728 \times 0.93$ (Fig. 6), $\quad 1 - f_H = 0.323$,

$\frac{TSR_1}{TSR_3} = \frac{7.09}{15.36} = 0.462$, $f_L = 0.562$ (Fig. 6), $\quad 1 - f_L = 0.438$, $\frac{(1 - f_L)}{(1 - f_H)} = 1.356$

(1) KW	(2) Table 4 Non-Extr. Load Factor	(3) $4/4\,L\,F_o \times$ (2) F_o	(4) 76200 − (3) $F_o - F_e$	(5) (4) ÷ 0.323 $\frac{F_o - F_e}{1 - f_H}$
3750	.62	47,200	29,000	89,800
5625	.81	61,700	14,500	44,900
7500	1.00	76,200	0	0
9375	1.19	**90,700	− 14,500	− 44,900

(**For calculation purposes only.)

(6) Load	3750	3750	5625	5625	7500	7500	9375	9375
(7) F_L, LP Extraction Flow, (Assume)	30000	60000	40000	80000	50000	100000	50000	100000
(8) $F_L \frac{(1 - f_L)}{(1 - f_H)}$, (7) × 1.356	40700	81400	54300	108500	67800	135600	67800	135600
(9) $\frac{F_o - F_e}{(1 - f_H)}$, column (5) at load	89800	89800	44900	44900	0	0	−44900	−44900
(10) F_H, HP Admission Flow, (8) + (9)	130500	171200	99200	153400	67800	135600	22900	90700

Plot line (10) vs line (7) on Fig. 5

Maximum intermediate flow $= \frac{(76200 - 4700)}{0.438} - 4700 = 167{,}900$ lb per hr (Used 170,000 lb per hr)

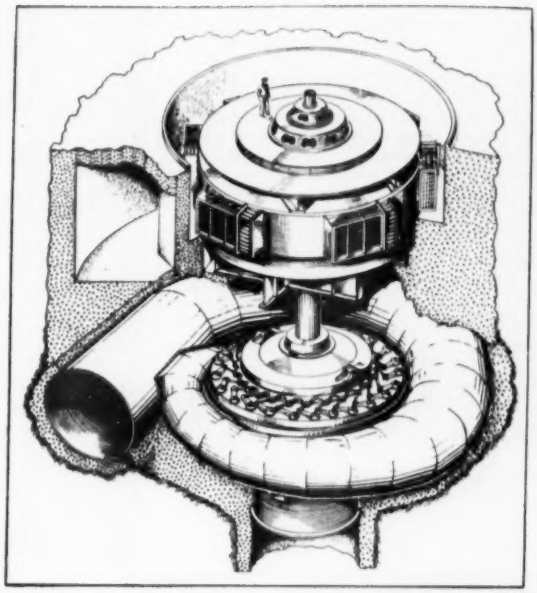
Maximum low-pressure extraction flow = 170,000 − 76,200 = 93,800 lb per hr

In Example 2, F_e is the minimum flow to exhaust from Fig. 7.

Data from the 9375-kw line on Fig. 3 is used to locate the 9375-kw load limit on Flg. 2 at the upper right end of the left-hand family of lines. Read simultaneous extraction flows from Fig. 3 at 9375 kw and add 4700 lb per hr to find the throttle flow. Enter Fig. 2 at 9375 kw, move vertically to the low-pressure extraction flow line, then horizontally to the high-pressure reference line, and then vertically to the throttle flow; the point just located is on the generator capability line for 9375 kw.

(Continued on page 114)

Hiwassee 102,000-hp Motor, & Pump-Turbine



World's largest electric motor and reversible pump-turbine being built for Hiwassee Dam

LARGEST ELECTRIC motor and reversible pump-turbine ever built will be the heart of a pump-storage project at Hiwassee Dam in southwestern North Carolina on the Tennessee Valley Authority's power network. The project is scheduled for completion late in 1955.

In this installation a single hydraulic machine will operate in one direction as a turbine and in the reverse direction as a pump. A direct-connected electric machine will serve as a motor for pump operation and as a generator for turbine operation.* Both will be built by the Allis-Chalmers Manufacturing Co.

When in service, water from Hiwassee reservoir, driving the unit as a turbine generator, will add needed energy to the TVA system in peak demand periods. During off-peak periods, when surplus power is available from other plants, the unit will operate as a motor-driven pump to lift water back into the reservoir. It will act, in effect, as a huge storage battery — storing energy.

There are many unusual aspects of the project. The reversible pump-turbine will utilize the largest Francis-type runner ever built. As a turbine it will have a maximum rating of 120,000 hp. When motor driven, the unit will have a pumping capacity of 3.3 billion gal of water per day, or nearly three times as much as New York City requires.

The pump has more than three times the capacity of each of those serving the Grand Coulee irrigation project, which are presently the world's largest.

Motor-generator is equally imposing. As a motor it will be the world's largest, rated 102,000 hp at 106 rpm. It is approximately 50 per cent larger than motors driving Grand Coulee pumps. As a generator it is rated 70,000 kva, 13,800 v.

Normal Operation

In a normal cycle of operation, the pump will begin lifting water from Apalachia Lake into Hiwassee Lake under a head of 135 ft at 5200 cu ft per sec. By the time the upper reservoir is filled, head will increase to 254.5 ft. Rated pumping capacity will be 3900 cu ft per sec against a 205-ft head.

At the beginning of operation as a turbine, the unit will generate 120,000 hp and drop to 36,000 hp as the reservoir approaches the low point. Guaranteed efficiencies are 90 per cent as a pump and 89.5 per cent as a turbine.

Application of this type of unit is economically feasible and profitable because off-peak power for pumping will cost less and improve load factor on the system, while power generated for peak loads will bring in more revenue.

Model tests, standard practice with all new turbine designs, will be made within the next few months at Allis-Chalmers' hydraulic laboratory where the tests will be witnessed and approved by the TVA engineers.

The company is also building a 12,000-hp reversible pump-turbine for the Flatiron power and pumping plant in Colorado for the Bureau of Reclamation. It will have a synchronous generator-motor which will run at 257 rpm as a generator when driven by the turbine and at 300 rpm as a motor when pumping. This unit, a new development in that it will be run at two speeds, is now under construction.

* Complete technical details of the principles and applications of pumped storage were given in the article Pumped Storage Hydroelectric Power, by Charles H. Spink, POWER ENGINEERING, October, 1951. This article gave examples of the use of the reversible pump-turbine for such applications.

New Vaporizing Oil Burner

VAPORIZING OIL BURNER, a new development, was described by J. A. Johnson and R. H. Eustice of the Thermal Research & Engineering Corp. at the annual meeting of the ASME in New York. This burner is capable of burning distillate fuel oils within a duct at a high rate as a result of internal pre-vaporization of the fuel. Entering air is preheated in a passage within the burner, then passes through the air nozzle into a concentric vaporizing tube. A larger diameter combustion cylinder is located downstream of the vaporizing tube. In operation, the fuel is sprayed into the vaporizing tube and the mixture of fuel and air is conveyed to the flame holder, situated between the vaporizing tube and the combustion chamber. By reason of the low pressure at the throat of the air nozzle, a portion of the burning or burned gases at the flame holder is recirculated through the annular passage around the vaporizing tube to the inlet of the vaporizing tube. These gases provide the heat necessary to heat the vaporizing tube, the combustion air, and fuel spray.

For ignition, the air flow at the nozzle is reduced to a velocity of about 50 fps and enough fuel is introduced to produce a fuel-air ratio corresponding to about 50 per cent theoretical air. The rich mixture is required to produce a combustible mixture of fuel vapor and air in the vaporizing tube and at the flame holder. Ignition by spark occurs near the upstream end of the vaporizing tube and the flame is carried down the tube to the flame holder since the flame propagation velocity is less than the mixture velocity.

This burner offers advantages in combustion space saving, nearly theoretical gas temperatures and products without carbon deposition, and controlled atmosphere generation by good burning at rich temperature. For saving space, the burner has been applied to a high heat release fire tube boiler and a high heat release gas heat exchanger. Both of these units have been operated for over one thousand hours and have demonstrated good operation with a high heat flux and efficient performance. In both cases, average heat transfer rates of over 28,000 and 19,000 Btu per hr per sq ft respectively have been attained. The elimination of a large combustion chamber directly reduces the space requirement. Other pressurized systems where space saving may be important are: chemical processes, pressurized boilers, gas turbine.

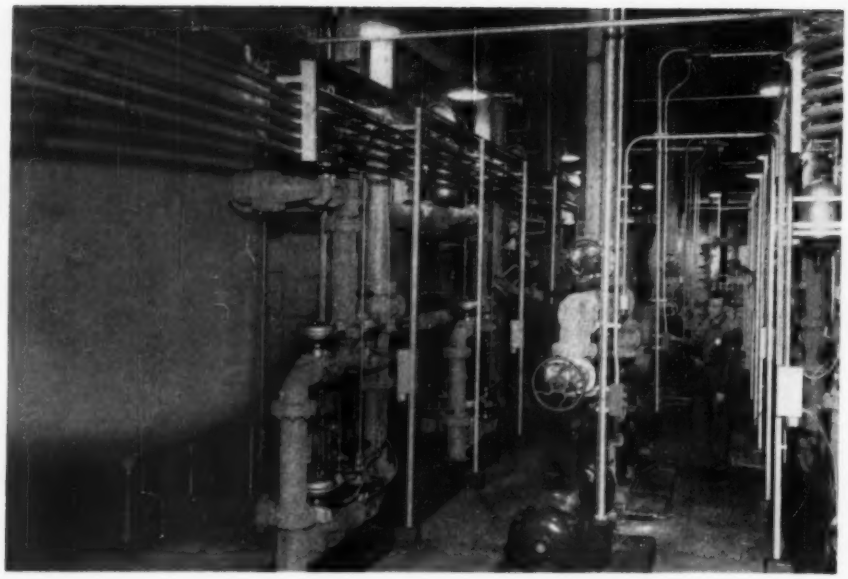


Fig. 1. Feedwater deionization plant of Philadelphia Electric Company at Schuylkill electric generating station in Philadelphia, Penn. Anion exchangers with pump and recirculation pumps at right

DEIONIZATION

Yields Low-Silica Feedwater

The Philadelphia Electric Co. finds new deionizing system produces water of high quality with silica content below measurable limits. Ionized solids content reduced to 2 ppm

ONE OF THE largest deionizing systems in operation by a public utility — that at the Schuylkill Station of the Philadelphia Electric Company — is delivering make-up water of 500,000-ohm resistance with a silica content lower than test limits will indicate — 0.05 of a part per million or less.

The two-bed system was placed in operation in December 1950, when the utility interconnected its Schuylkill boilers with the district steam system it operates in downtown Philadelphia. Because no condensate would be returned to the boiler system, it was necessary to provide make-up of high quality water for two boilers operating at 1350 psi and 20 operating at 220 psi.

With several millions of dollars involved in the complete change-over, the selection of water-conditioning equipment came in, naturally, for impressively thorough study. One plant examined, using zeolite softeners, delivered an effluent averaging 200 ppm in total dissolved solids, with a silica content as high as 2 ppm. The effects of such water on the high pressure boilers at Schuylkill were unpleasant to contemplate.

Accordingly, the investigation turned to silica-removing deionization, because of the rapid advances made in the applications of ion exchange to the conditioning of waters over the past several years. The efficiency of cation exchangers in removing metallic ions has been well recognized. By employing a strongly acidic cation exchanger in the hydrogen form, soluble salts could be converted to their corresponding acids. The more recently developed strongly basic anion exchangers then permitted essentially complete removal of these acids, because of their high capacity for weakly acidic constituents, such as silica, carbon dioxide, and hydrogen sulfide. The advantages of silica removing deionization include:

1. Extremely high quality of the treated water
2. Low equipment cost, compared with multiple effect evaporators
3. Low operating cost
4. Low maintenance cost
5. Assured, adequate supply of conditioned water, regardless of variations in raw water quality and demand for conditioned water.

The unit installed at the Schuylkill Station by the United Engineers & Constructors, Inc. was developed by the Philadelphia Electric Co. engineers in collaboration with the Graver Water Conditioning Co., who manufactured the equipment; and with Rohm and Haas Co. and the Dow Chemical Co., whose ion exchange resins play an important role in the efficiency of this operation.

The plant includes a battery of four cation exchange units, two degasifying towers, a second battery of four anion exchange units, and a large storage tank for treated water. Raw water first passes through the cation exchange section. Each column is 11 ft in diameter, 14 ft high. The columns contain beds 6 ft deep of a medium capacity Amberlite IR-105G cation exchanger, which serves to convert all salts to their corresponding acids. The water is then aerated to remove carbon dioxide.

From the degasifying towers, the effluent is pumped to the anion exchange columns. These columns are 11 ft in diameter, 12 ft high, and contain beds 4½ ft deep. Two of the four contain Amberlite IRA-410, and two units are charged with a strongly basic anion exchange resin of similar type. The bed depth of 4½ ft was specified in order to: (1) guarantee a silica content of less than 0.1 ppm; (2) assure minimum interference between strong acid removal and weak acid removal in the anion exchange bed; (3) minimize the frequency of regeneration; (4) reduce caustic re-

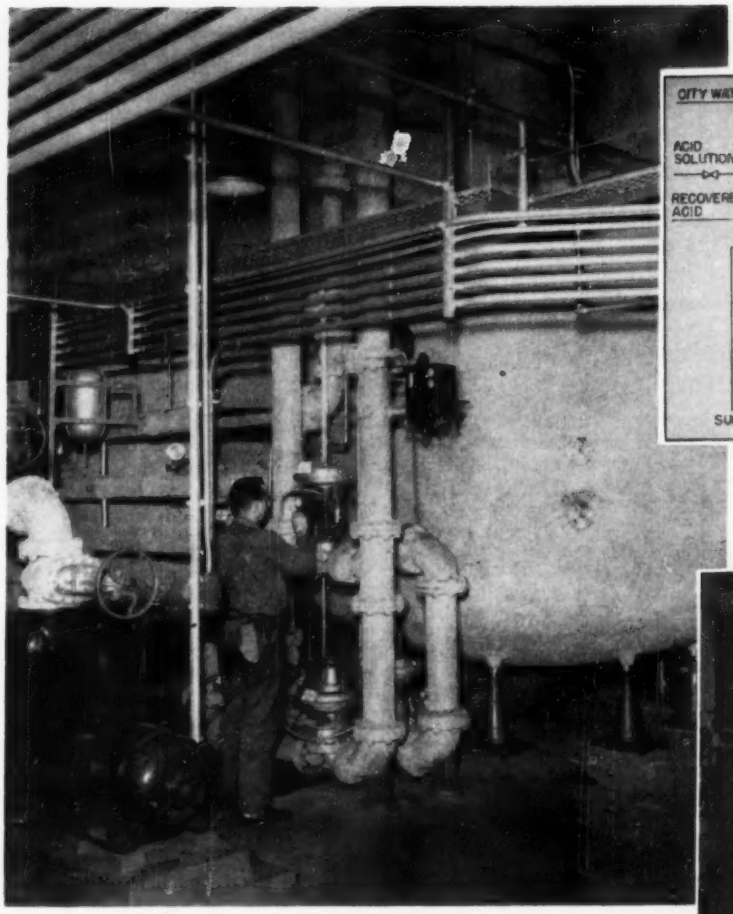


Fig. 2. (left) The cation exchange unit and the control valving

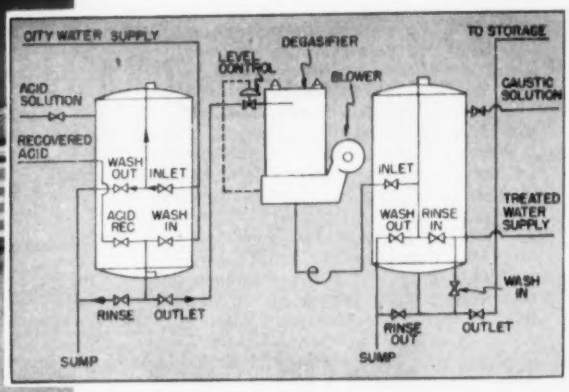


Fig. 3. (above) One-line diagram of arrangement of demineralizer

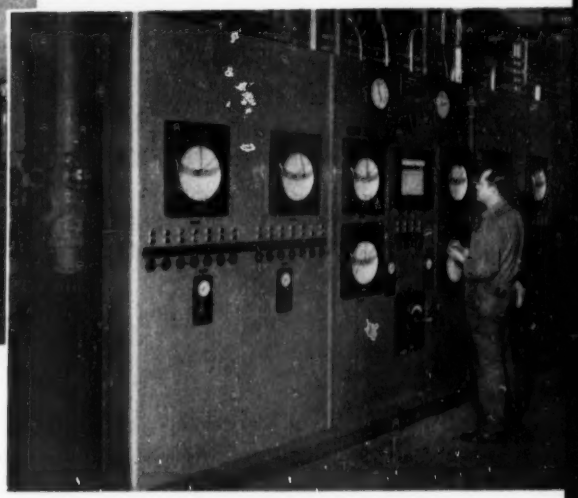
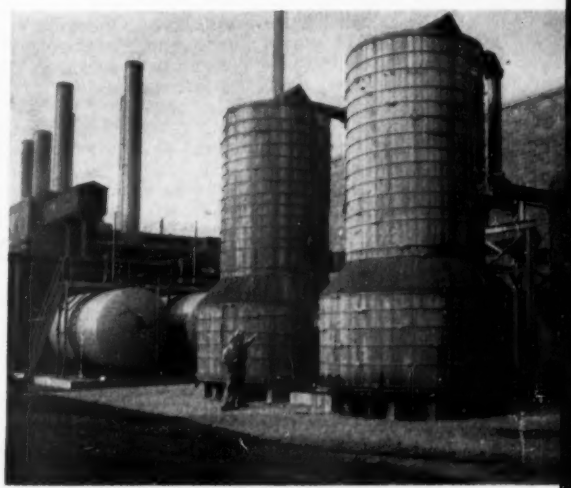


Fig. 4. (above) Anion unit control panel of demineralization unit

Fig. 5. (below) Degasifier towers of the demineralization unit



quirements for regeneration, since a deep bed assists in meeting quality requirements at reduced regeneration levels. After leaving the anion exchanger, the deionized water goes to the storage tank, which has capacity for 1,000,000 gal. This represents a 14-hr supply of make-up water at full load rate.

The Amberlite IR-105G cation exchanger is regenerated with sulfuric acid at the rate of approximately 2.5 lb per cu ft. The anion exchanger is regenerated with caustic soda at the rate of 5 lb per cu ft. By mixing the waste solutions after regeneration, they become self-neutralizing, and the pH can be controlled between 7 and 9 with only small additional quantities of acid or alkali. This method has an important bearing on the economics of the process, since it permits the discharge of harmless wastes at minimum cost of treatment.

In appearance, the entire deionizing plant might serve as a model, since it reflects careful design throughout. All components that carry acid or deionized water are fabricated with corrosion resistant materials. Monel metal and stainless steel are widely used. Vulcanized sheet rubber is employed as a lining for the ion-exchange columns. Rubber-lined and rubber-covered piping is used where needed. The storage tank and its 12-in. feed pipe are coated with multiple spray coats of a polyvinyl chloride coating. Similar treatment is given to the make-up water pipe-line, which carries the deionized water to the deaerating heaters.

The plant is completely instrumented, permitting essentially one man operation. Valves associated with the units are equipped with position indicators and indicating lights. Flow meters indicate and record flow rates at all critical points. A four-point instrument registers conductivity of the water. An automatic pH indicator continuously samples regenerant wastes, permitting control of neutralization by the operator. *(Continued on page 114)*

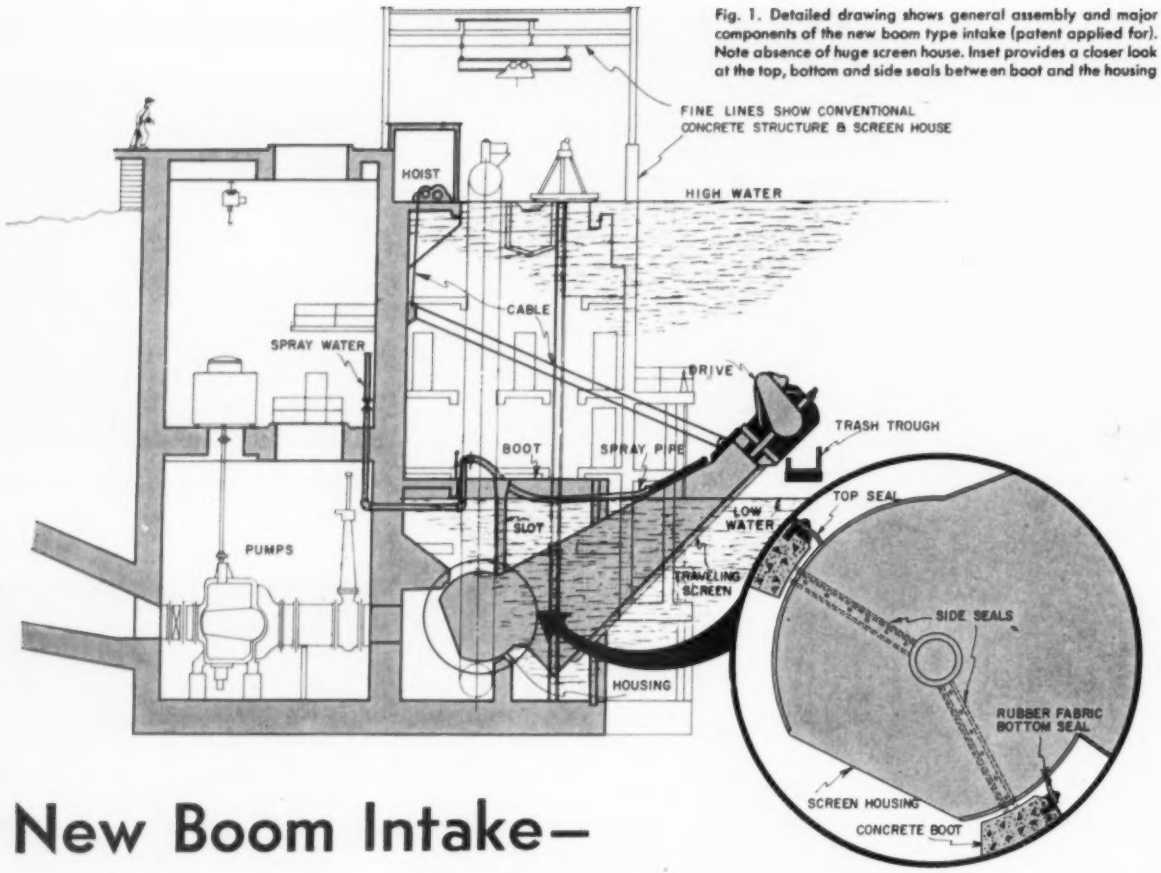


Fig. 1. Detailed drawing shows general assembly and major components of the new boom type intake (patent applied for). Note absence of huge screen house. Inset provides a closer look at the top, bottom and side seals between boot and the housing

New Boom Intake—

Will It Cut Screening Costs?

Eliminate the screen house? Halve intake costs? Provide cleaner water? The new boom type intake, as developed by the author, may do just that in future power plants. Here is why he thinks so!

By GEORGE RODEMEYER *

Design Engineer

FOR THE PAST half century river water used in steam power and industrial plants has been cleaned by being run through traveling screens set in concrete chambers. These massive chambers, extending from river bottom to the point of highest expected flood, are comparable to large concrete buildings, frequently 6 to 8 stories in height.

Recently, a visitor at one plant, pointing to the screen house, asked, "And, what is that building?" The attendant answered, "That takes the dirt out of the water." "That," said the visitor, "sure is one *big* strainer!" Perhaps, there is something for us to think about in this remark — an eight-story structure serving as a water strainer, in some instances for a couple of 60-in pipes. From this viewpoint, we must admit that technological advancement has somewhat overlooked the humble river-water intake.

High Cost of Screens

Conventional designs are based upon keeping the unit in operation during highest flood periods which occur less than 5 per cent of the time, or never, in the life of the plant. This results in installations with screens often approaching 100 ft in length, and which operate most of the time in water that may be only 20 ft deep. In other words, 200 linear ft of traveling screen is needed to screen a 20 ft depth of water; which, of course, means a good deal of maintenance work on screen baskets, chains, guides and pins.

Not only size of the structure should get our attention but also its cost which, in plants along rivers subject to floods, approaches $200,000 for a capacity of 100,000 gpm. In other words — a $2 investment for screening 1 gal of water per min. Of this amount, about 25 per cent goes for screening equipment, while the balance is charged to structures.

Trouble-free operation in screening river water does not necessarily follow such expenditure. In an effort to reduce costs, screens are kept at a minimum width; therefore, to attain maximum effective screening area at the lowest water level, screens are extended to the river bottom and sometimes below. Water taken in at

*George Rodemeyer is now associated with one of the larger power utilities. At this early stage no specific plans have been projected for the development, but it is hoped that in the near future, with the help of screen manufacturers, plans can be completed for the construction of an experimental unit.

river bottom carries mud through screens, especially when the river is turbulent during and after storms. This means discolored gage glasses, plugged instrument connections, more tube erosion in condensers and coolers, and more mud in the plant water treating system. With every rain storm water-soaked timbers, sticks and leaves move downstream on the river bottom and frequently are drawn into screen chambers.

Since the traveling screen, as now designed, cannot cope with larger debris, an auxiliary grill is installed in front of the screen. Sometimes these trash grills are installed outside the chamber entrance, requiring removal of debris by hand from outside platforms and floats. When the grills are located inside the chamber entrance debris is trapped, and must be carried to the surface by mechanical rakes, grab buckets, or by hand. Should water-logged timbers or stumps drift into the entrance and foul the rakes, only hand labor can keep the grills open and the unit in operation.

Inherent to conventional intake design is the necessity of raising all trash to the operating level at the top of the chambers before returning it via sluiceways and pipes downstream to the river. During higher river stages water rises in the vertical pipes blocking the flow of debris, which often backs up into the trash trough and prevents proper cleaning of screens.

Inspection and repairs at the bottom of the screen chambers requires closing of stop logs or gates, pumping out water, and removing mud. If gates cannot be closed because of some obstruction at the bottom, it becomes necessary to send down a diver. If a screen gets stuck and refuses to lift, or if gates and stop logs require caulking before pumping, use of a diver again becomes necessary. All of these items point to the need for much hand labor and expense to keep screens in operating condition.

Use of Boom Intake

The boom type intake (patent applied for), shown in Figs. 1 and 2, represents many advantages over the conventional type intake shown in Fig. 2A. It consists of a steel housing pivoting in a concrete receiving boot and containing a traveling screen supported on guide angles within the housing. The screen unit is made to slide into position in the housing and can be withdrawn readily for inspection and repairs. Details of the water seals for the boot assembly are shown in the inset in Fig. 1. Bottom side of the housing is open and the screen passes over this opening to screen incoming water. Water then passes through the housing and boot to the intake tunnels and pumps.

In its normal inclined position the screen traverses the water on an angle, thus considerably increasing its effective area. Trash trough may be located permanently several feet above normal river level, either in front or behind the screen, discharging downstream without use of additional flumes or pipes. When the river rises to the level of the trough, the screen unit is raised to a point well above expected rise, in which position debris is returned directly into the river where turbulence carries it away. Under conditions of insufficient turbulence when accumulation of debris might encumber the screen, a stationary upper trough is installed behind the screen with a movable branch trough to the front of the screens.

Raising and lowering of the unit is done by a hoist located within the adjacent building. Where the intake is too far from the plant building, a hoist tower is required to keep the hoist above highest flood water. At maximum flood stages the unit is raised to the vertical position and locked to the building, or tower, as the case may be — operating in this position until the flood recedes. Movement of the screen may be float controlled.

Boom type screen practically eliminates the conventional screen house's deep concrete chamber, and all its appurtenances together with grills,

(Continued on page 119)

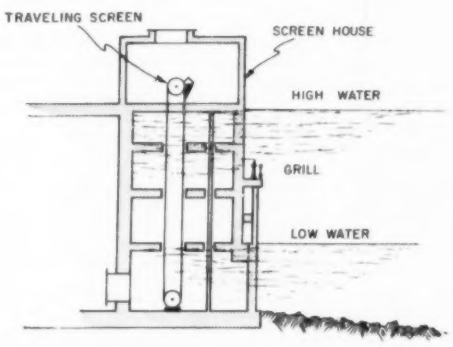


Fig. 2A. A conventional type intake system showing large screen house, vertical screen and grill

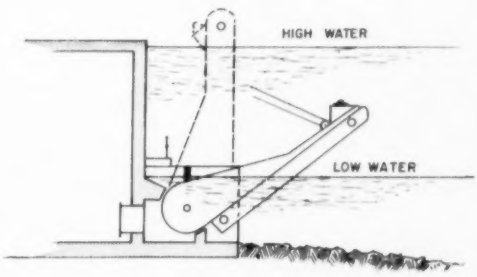


Fig. 2B. Comparison of new boom intake with conventional shows its construction advantages

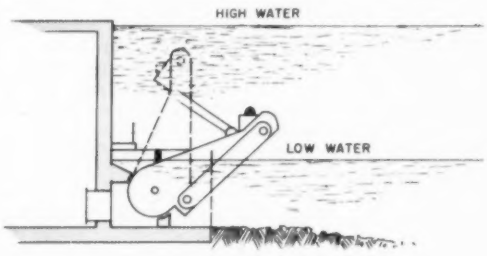


Fig. 2C. Diagram of boom type intake with submersible drive which can operate in flood stage

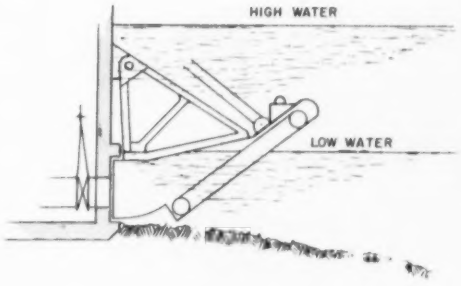


Fig. 2D. Diagram of boom type intake constructed for fixed operation with boot eliminated

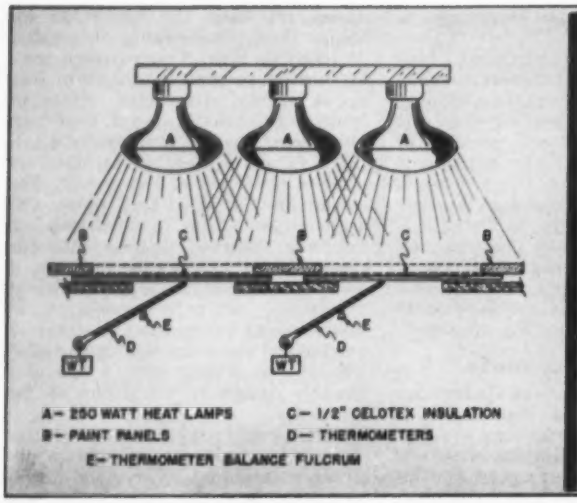


Fig. 1. Illustration of the layout devised to test the absorption and emissivity of various painted surfaces. The results of the tests are shown in Table II

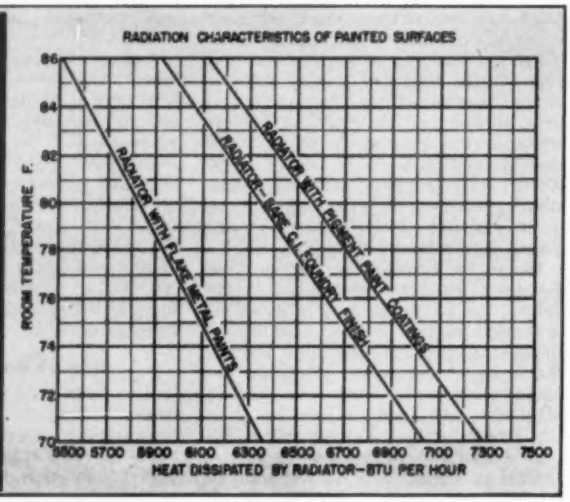


Fig. 2. Fessenden and Martin evolved these curves in 1929. Grouping of types and colors shows the differentiation between metallic and pigment paints

How Does Your Power Plant Paint Absorb Heat?

Simple tests for heat absorption, and consequently emissivity, of various painted surfaces can help you select the right paint for plant equipment. Here is a report on such a test and the conclusions

By L. G. JONES

A PREVIOUS ARTICLE, In Your Power Plant Painting Program, Make Simple Reflection Tests, in the December issue, just led us into the problems of reflection, radiation and absorption of heat. Normally at lower atmospheric temperatures the effects of heat transfer on inanimate objects are not given much thought. We concentrate on our body comfort and go to great lengths in winter heating and summer cooling to maintain such comfort. Surface radiation and air circulation methods of heat transfer have received a great deal of study and financial backing.

Under the radiation heat transfer formula,

Heat Radiation = KeA ($T_h^4 - T_c^4$),

for atmospheric temperature ranges, the difference in the fourth power of the two surfaces is not so great compared to the transfer achieved with hot furnace wall temperatures exceeding 2000 F, such as encountered in opening a boiler inspection door. Fessenden and Martin in their paper, ASH&VE, Chicago, Jan. 28, 1929 [1], evolved the curves shown in Fig. 2. There is a sizeable difference in heat radiation from steam radiators painted in different colors. Grouping of various types and colors is very significant in the differentiation of metallic and pigment paints.

In some of the tests up to 6 coats of pigment paint on the tubular radiator resulted in a sort of built-up insulation. This is interesting in comparing heat losses from metal surfaces with shiny coatings against thin insulation. In warm air ducts in house heating, bright-surfaced tinned or galvanized sheet metal was preferred to a single thickness of asbestos paper. Studies by Pennsylvania State College [2] showed that the use of bright aluminum foil 0.0003- to 0.003-in. thick reduced heat loss from bare steam pipe by 25 per cent. A single sheet of standard insulating material caused a heat loss 10 per cent greater than bare pipe.

With temperatures the same for all these colors, it can be safely assumed that the property of these paints that produces differences in heat transfer is emissivity — e in the formula. Emissivity is the ratio of the amount of heat radiated by any surface to that radiated by a really black surface, such as one would find in a sealed, lightless chamber.

Eddy and Nelson, Texas A&M College [3] list the emissivity of some common house materials at room temperature, based upon Coblentz's formula whereby a black body will radiate 133 Btu per sq ft per hr at 68 F. If a wall radiates 80 Btu per sq ft per hr, its emissivity is 0.60.

Figure 1 briefly sketches the layout devised for these tests. Three industrial-type 250-w infra-red heat lamps were mounted 19 in. above two 2½ in. by 9 in. panels so that the two panels would receive their heat radiation simultaneously. Three lamps were used in order that a more uniform dispersion of the heat rays over full surfaces of the panels would be obtained, rather than a concentrated focus of heat on any one spot.

Each panel was placed under a slot, or aperture, measuring 2 in. by 6 in. in a ½-in. thick celotex insulating board in order that no conducted heat from adjacent surfaces would enter the panels. They received all of their heat through the fixed apertures.

A glass mercury thermometer was balanced under each panel so that the mercury bulb was in contact with the uncoated metal underside of each

Table I. A few selected coefficients of emission

Material	Emissivity
Black body (theoretical)	1.00
Bare concrete	0.83
Lime-sand plaster	0.85
Alabastine	0.79
White (lead) paint	0.77
Aluminum paint	0.36
Gray paint, glossy	0.808*
Black paint, glossy	0.796*
Steel gray sheet	0.89*
Bright galvanized steel sheet	0.526*
Bright tinned steel sheet	0.481*

* Recalculated from data of T. W. Reynolds, *Gas Age Record*, June 13, 1925.

Table II. A summary of the equilibrium temperatures in degrees F which are shown in Figs. 3 and 4

Coating	Final Temperature New	Final Temperature Weathered	Rise (F) Above 68	e Ratio to Soot [1]
Soot	155.1	155.1[2]	87.1	1.000
Black gloss	151.8	152.0	84.0	0.965
Gray gloss	140.5	144.0	76.0	0.873
Aluminum-1	121.5	134.1	66.1	0.762
Aluminum-2	125.1	134.0	66.0	0.760
Aluminum-7	116.0	127.0	59.0	0.688
Aluminum-8	121.0	124.0	56.0	0.642
Aluminum-9	118.1	125.8	57.8	0.661
Mirror	110.0	110.0[2]	42.0	0.483

[1] Calculated.
[2] Not weathered.

Table IV. Relative emissivity of painted radiator

Coating	Output in Btu per sq ft	Calculated Relative e
Bare iron	240	0.89*
Flat green	230	0.85
Maroon japan	240	0.89
Flat white	242	0.90
White enamel	242	0.90
Gold bronze	205	0.76
Aluminum bronze	200	0.74

* Bare cast iron taken from Table I as base coefficient of emission.

panel. Entire panel and the thermometer were shielded against undue heat loss or gain from external sources. Each panel under the heat lamps rose in temperature until equilibrium was reached. The same paints were subjected to this heat absorption process as were tested for reflectivity and illustrated in the previous articles.

As in the reflective tests, two standards were set up. The single strength, highly-silvered glass mirror was used for minimum absorption. A bare steel panel was coated on the top side with carbon from a candle flame to approach the maximum, or black body, radiating capacity.

Procedure was to place the panels in position under the aperture, set and read the thermometers, turn on the three heat lamps, and then read the thermometers every two minutes. The readings followed the pattern of heat absorption curves, rising more rapidly from cold or greatest temperature difference, reaching a point of equilibrium in about 15 minutes, and then maintaining a level temperature thereafter. It is presumed that the level temperatures signify that heat absorption and heat losses have balanced each other.

The curves, Figs. 3 and 4, tell the story. Height of the equilibrium temperatures, or the rise in temperature, seems to be a function of the absorption characteristics of the paints. This is converse to their respective emissivities. Table II summarizes these equilibrium temperatures. Since all panels started off at the same room temperature, the equilibrium temperature truly represents the rise in temperature attributed to each panel with its specific coating, under identical conditions.

The emissivity ratios of Table II are not too far from those of Table I, although the calculated emissivities of the bright metallic finishes such as aluminum, galvanized and tinned steel and the mirror seem high. However, other sources from compilations by T. W. Reynolds give the following increases in temperatures of liquids in various tests:

Next are some figures on the painting of steam radiators, showing the relative radiating value in Btu for a two-column, 38-in. cast iron radiator painted different colors from the *Journal* of the American Society of Heating and Ventilating Engineers, by John R. Allen, March 1920, and published by T. W. Reynolds, *Gas Age Record*, June 13, 1925.

Table III. Reynolds' equilibrium temperatures, F

Color	Rise in Temp., F Flat	Rise in Temp., F Gloss	Calculated e Ratio Flat	Calculated e Ratio Gloss
Black	10.5	7.9	1.00	0.75
Red	8.2	7.7	0.78	0.73
Green	7.1	6.9	0.68	0.66
Blue	6.7	6.1	0.64	0.58
Yellow	5.8	5.5	0.55	0.53
White	3.1	2.9	0.295	0.277

Water in painted tubes exposed to rays of nitrogen-filled lamps for 20 minutes.

Fessenden and Martin presented the results of their heat emission tests at the University of Michigan at the ASHVE, January 1929, in graphic form. Figure 2 is reproduced with straight lines combining all paints into three groups:

(a) Flake metal paints, aluminum and gold.
(b) Bare cast iron (or steel) metal.
(c) Pigment paints, white to brown.

General Conclusions

Our own simple tests brought out the same general results that others had obtained in the various sources quoted. One can come to several general conclusions from these data:

(1) Metallic coatings give the greatest reflection and the least radiation. These properties increase with the brightness of the coating.

(2) Pigment paints give the lowest reflection and the greatest radiation. Reflection is increased and radiation reduced by any increase in glossiness of the pigment coatings.

(3) There is not too much difference between members of each group, so that esthetic or policy requirements can be met within reason by any colors within any group.

Recommendations

Applying these generalizations to our own specific plant problems, we could recommend:

(1) Tanks storing volatile liquids such as propane, gasoline, solvents, etc. should be painted aluminum.

(2) Water towers, fuel oil tanks and containers whose temperatures should be maintained against hot or cold surroundings should be painted aluminum.

(3) Transformers, steam radiators and equipment whose heat content should be dissipated by the surroundings, should be painted in pigment colors. Transformers will not be inefficiently air cooled if they are painted battleship gray, brown or black — or any color that has been adopted as standard.

[1] *Heating and Ventilating* Magazine, February, 1929.
[2] Prof. F. C. Stewart, *New York Times*, June 24, 1931.
[3] *Heating and Ventilating* Magazine, June, 1938.

Fig. 3. Time needed to reach equilibrium temperatures is shown for Group I of heat absorption tests

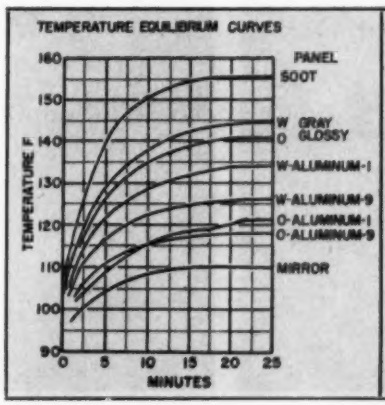
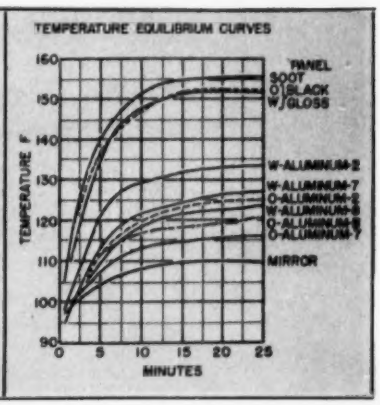


Fig. 4. Time needed to reach equilibrium temperatures is shown for Group II of heat absorption tests



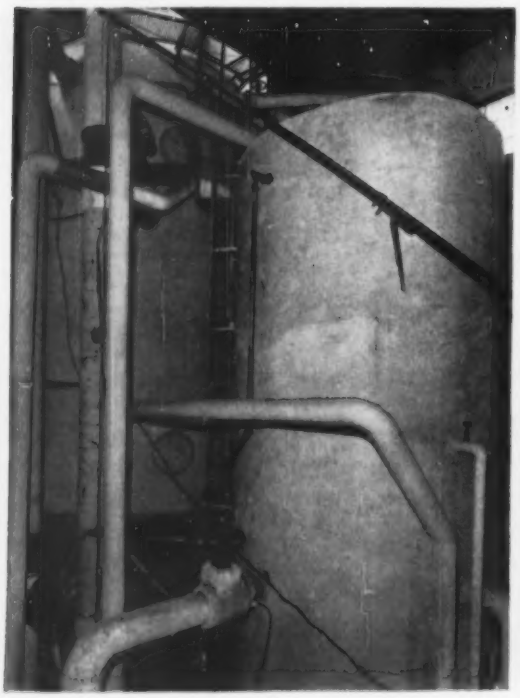
Above. Aerial view of the Pasco Packing Company plant at Dade City, Florida

Right. Front of 50,000 lb per hr boiler with forced draft fan in foreground

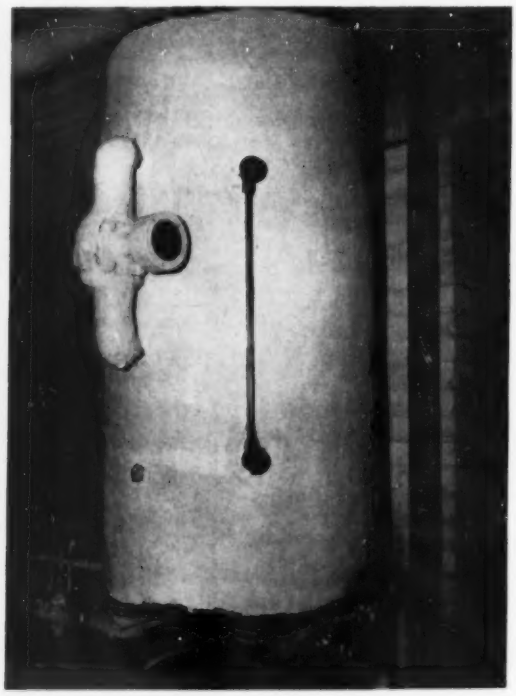
HERE ARE pictures of the plant where A. T. Lohkamp who wrote in the October 1952 issue—How We Saved Power and Refrigeration $$$—is Steam and Refrigeration Engineer, and some of the pieces of equipment upon which he has performed some down-to-earth engineering to enable the equipment to operate more efficiently and save money. He insulated steam lines which never had been before. Applied capacitors for power factor improvement and reduced loading of the generators. Installed a continuous blow down system with a flash tank for boilers so they could maintain constant solids

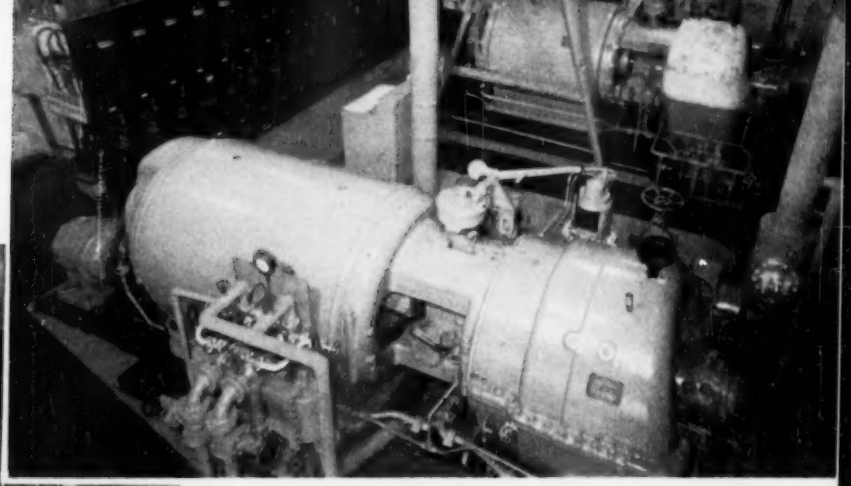
Power Engineering NEWS REEL

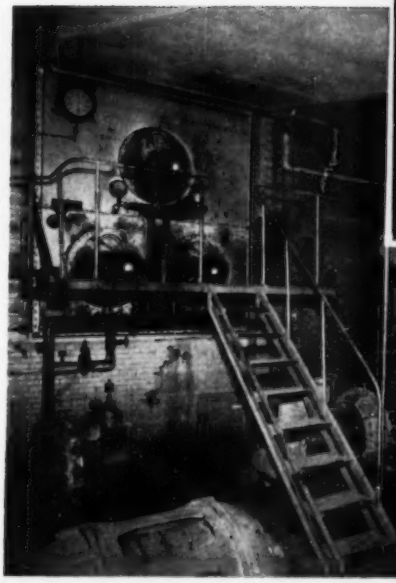
Water softener. At right is first stage hot lime soda softener rated 18,000/27,000 gph. At left is second stage hot phosphate softener



Flash tank on blow down water which helps maintain constant solids concentration in the boiler water and reduce rate of blow down







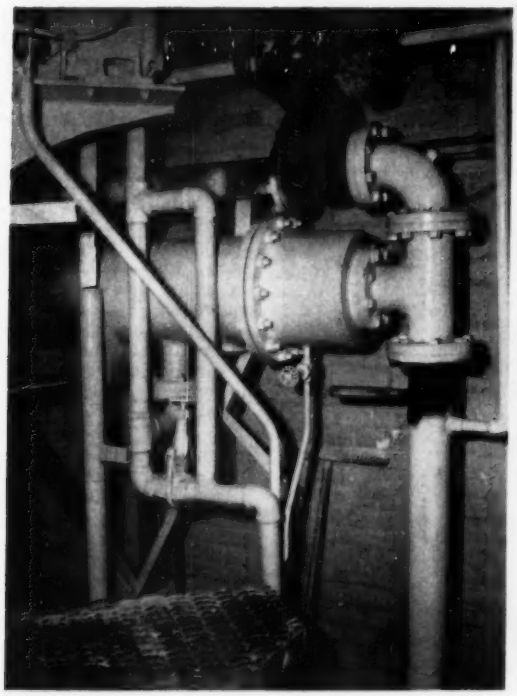
Above. 1000 kw non-condensing, 1500-kw condensing turbine-generators

Front of 100,000 lb per hr boiler. Note this boiler like others is oil fired

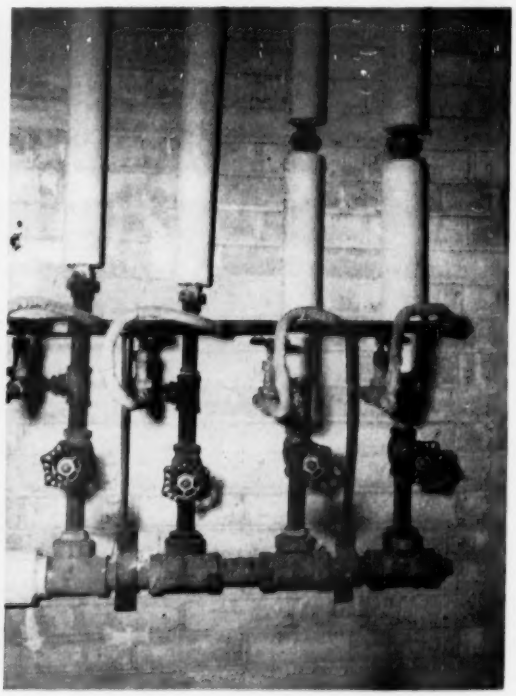
concentration in the boiler water and reduce rate of blow down. An automatic air purge was applied to the ammonia refrigeration system which decreased the discharge pressure by two lb and saved nearly one per cent in power consumption. Acid cleaning the ammonia compressors for the first time reduced an excessive discharge pressure of 20 lb to slightly above normal. Finally, acid cleaning of the anthrafilt in the filters for the water softener effluent resulted in saving the price of a new charge of graded anthrafilt for each of five filters. Turbine condensers were acid cleaned also.

Visits Pasco Packing Company

Inlet end of homemade heat exchanger for exchanging heat from flash tank discharge water to softener inlet water. Water temp. 228F



Boiler continuous blow down header within easy reach of men who check boiler water. Adjustment of these valves controls blow down



A Power System

Fig. 1. General view of the Detroit Edison Co. System Analog and Network Computer. The analog is shown at the left. A portion of the computer is shown at the right. The instrument console is in the center of the room

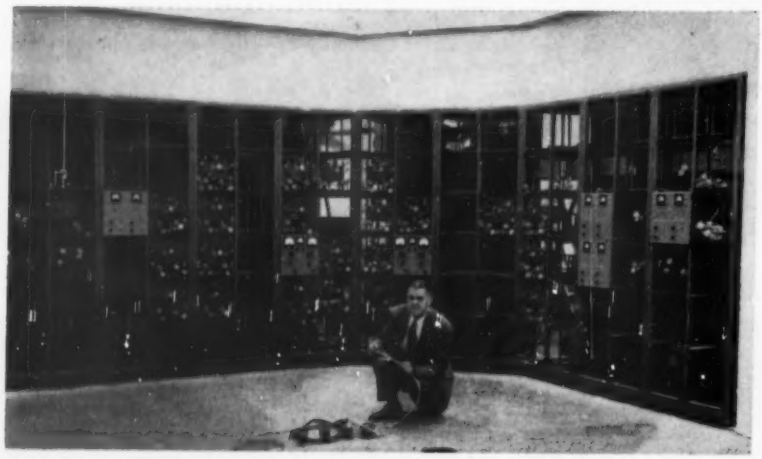


Fig. 2. Perc Fugill of the Detroit Edison Co. posed before the cabinets of the analyzer during construction

Fig. 3. Lots of soldering was needed on the job. At times 9 men were working on the project. This view shows the assembly of some of the flat resistor units used to minimize inductance and dissipate heat

THE USE of network analyzers for system planning is a definitely established practice with most of the power companies in the United States. During the last two decades such system analyzers or network computers have been installed in electrical manufacturing plants, electric utility headquarters and engineering colleges. Many of you have probably seen, or seen pictures of, these complicated devices and have wondered how they work. Just what are they used for, why are they called network computers?

In outward appearance these computers seem mysterious and complex. They consist of groups of many panels containing innumerable instruments, switches, jacks, cords, and, usually, a central control desk or console, all interconnected by thousands of wires. The complexity of these machines, however, lies largely in the multiplicity of their parts and connections; in principle they are reasonably simple and not difficult to understand.

A network computer is an assemblage of adjustable resistors, inductors, and capacitors; power sources whose voltages are adjustable both in phase and magnitude; instruments for the measurement of both scalar and vector values of current, voltage, and power; and provisions for interconnecting these elements in any manner desired to form a network. It can, therefore, be connected to simulate an actual power system.

Consider a simple case of merely a generator feeding a load at the end of a transmission line as shown at (a) in Fig. 4. Suppose it is desired to know what effect an increase in inductive load will have on the generator. The most obvious way of course would be to go out with instruments and make actual measurements on the system itself. This, however, is not always expedient. Another way would be to calculate the effect either analytically or graphically. This is simple enough with a simple system such as the one illustrated but as systems increase in complexity the calculations become correspondingly complex, and with the large interconnected systems in use today, calculation is virtually impossible.

Here is where the analyzer principle comes into the picture. Suppose we set up a small circuit of little transformers, resistors, variable in-

Analog and Network Computer

Detroit Edison Company has installed its own System Analog and Network Computer, making it one of the few utilities in the world with a computer for its exclusive use. Here is a brief description of the analog together with explanation of how computers work, why power systems need them

ductors, capacitors, etc., to simulate the actual system, as shown inFig. 2 and at B in Fig. 4. Here, the generator is represented by a small step-down transformer the output of which represents the generator voltage on a 100-to-1 scale. Since the actual generator has internal resistance, inductance and capacitance, these parameters are represented in the analyzer by the three units indicated, i.e., a variable resistor R_g, a variable inductance L_g, and a variable capacitor C_g. The transmission line parameters are similarly represented by the units R_l, L_l, and C_l. The load also is so represented by R_l, L_l, and C_l.

Thus, by manipulating the variable inductor L_l we can simulate an increase of inductive load on the actual system, and to find out what has happened as a result, we have merely to connect the terminals of the four measuring instruments to the proper points in the *analog* circuit. The instrument readings will be proportional to the actual changes in current, power, voltage, and power factor in the actual system. The instruments can be calibrated in terms of per cent so as to make readings applicable to all conditions.

Now, this is exactly what is done with an actual system analyzer. Instead of only one generator, one transmission line, and one load, there can be as many generator units as there are generators on the system. There also will be many *line units*, each representing an actual transmission or distribution line. Also, there will be many loads. These various units, that is, generator units, line units, and load units, are so arranged that they can be connected in any desired fashion to represent actual systems. The instrument consoles are designed so that readings can be made of voltage, current, power, power factor, etc., at any point in the system, no matter how complex the latter may be. This is done by means of selective relays actuated by push button switches on the console.

Once properly set up, the computer will accurately represent the actual system; in other words, it is *analagous* to the system. Hence, these devices are also called *analog* computers.

When one stops to consider the complexity of modern power systems with dozens of generating stations each containing a number of generators, complex networks of transmission lines, substations, load centers, etc., it will be readily apparent that these system analyzers can be extremely valuable in making studies of existing and future conditions. As indicated at the beginning of this article, the use of these analyzers has become a definitely established practice with most power companies in this country. Until quite recently, their use was confined largely to problems involving system planning. Little use was made of them for purely operating purposes.

This was so with the engineers of the Detroit Edison Company. For many years they had made use of network calculators at universities and manufacturing plants to solve their complex network problems. This was done on a rental basis which did not allow solution of as many problems as desired, so in 1946 the Company began active design and construction of its own System Analog and Network Computer. This equipment illustrated in the accompanying photographs was placed in service early this year.

The operating people in the Detroit Edison system had felt for some time that the Company would benefit considerably if more time were available on an analyzer for the solution of operating problems on the system as it stands today. Typical of such problems are studies of the economic loading of plants and the effect on the system of such loading, or the distribution of reactive load among generators and its effect on voltage regulation and stability.

Because most studies of this nature concern the bulk power system as it exists today, it seemed desirable to combine a conventional, completely-variable network calculator (the Network Computer) with a fixed, permanently-connected section (the System Analog). This latter section is, in effect, a factual reproduction of the bulk power system, with the sub-transmission system represented by an equivalent network. For this type of calculator, which is essentially tailor-made, it was more satisfactory for the Detroit Edison Company to design and construct the unit, rather than purchase it from one of the manufacturers of such equipment.

Thus, the Detroit Edison Analyzer consists of two parts: 1. the System Analog section made up of ten racks each 2½ ft wide by 7 ft high by 3 ft deep, and 2. the Network Computer, consisting of eight racks of the same type used in the Analog plus two plugboards for connecting and transferring units. Included in this section are the generators, transformers, impedances, pi circuits, synchronous condensers, capacitors, and loads for use separately or in conjunction with the system analog.

With the analog representing the actual Detroit system, it is necessary to make modifications in the analog, whenever permanent additions or changes are made in the system. The

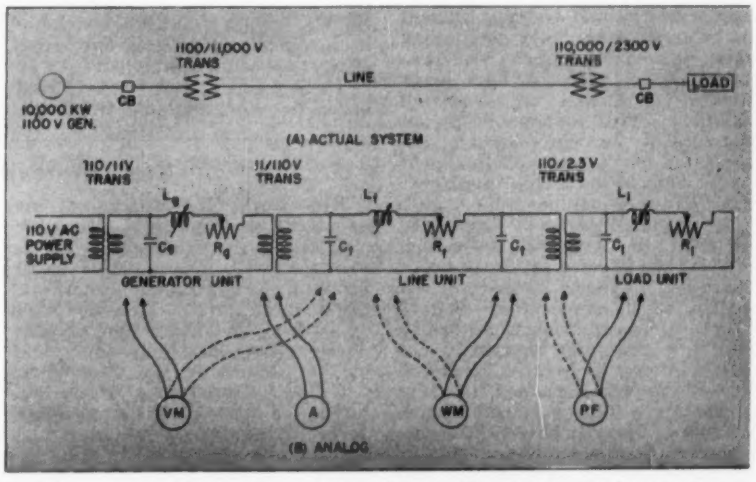


Fig. 4. Elementary principle of the System Analog and Network Computer is shown in this wiring diagram

affected components have to be replaced by new impedances or additional impedances connected into the network. To make all components readily accessible for such replacements, the removable-drawer type of construction is used. Since the analog units are identified by the specific names and numbers used for the system counterparts, it is relatively simple for anyone familiar with the system operation to make all adjustments on the analog. If one of the turbine generators at, say, Trenton Channel is shut down, the analog will show voltages throughout the system, tell whether lines or transformers will be overloaded, etc.

Many problems involve future changes and expansions to the present system, which must be studied before the change is actually made. For this purpose a jumper bus arrangement is provided so that any unit in the analog may be disconnected and replaced by any unit or combination of units from the network computer. In addition to this function, the computer section can be used occasionally for all problems involving the subtransmission system, the distribution system, or special networks within the limits of its capacity. It can also represent other systems in joint interconnections studies.

As indicated at the beginning of this article, though the principle of the analog is relatively simple the connections are complex, particularly with respect to relaying, that is, the arrangement whereby the measuring instruments on the console may be connected to any of thousands of points in the system. The Detroit Edison equipment weighs some four tons, includes 22 miles of wire, 700 relays, 2500 switches, 75,000 soldered connections and cost in the neighborhood of $130,000.

While no attempt will be made here to describe the circuit in detail, a brief description of the *generator units* will be of interest. It might be possible to represent the actual generators on the system by small rotating machines with comparable characteristics but it would be very difficult and expensive to build such small units.[1] It is much more convenient to represent each generator by a power source. The voltage adjustment of the source then corresponds to adjustment of the field current of the generator, and the phase adjustment corresponds to the setting of the governor on the prime mover.

A diagram of the power supply and the generator connections is shown in Fig. 5. The type of generators used requires a 12-phase regulated power supply which is obtained from a 4-wire, 3-phase network feed working into three electronic regulators connected in grounded star. The output side of the regulators feed the delta primary of a 3-phase bank of transformers of 15-kva capacity, the secondaries of which are connected in diametric star to give a 6-phase output. The insertion of T-connected

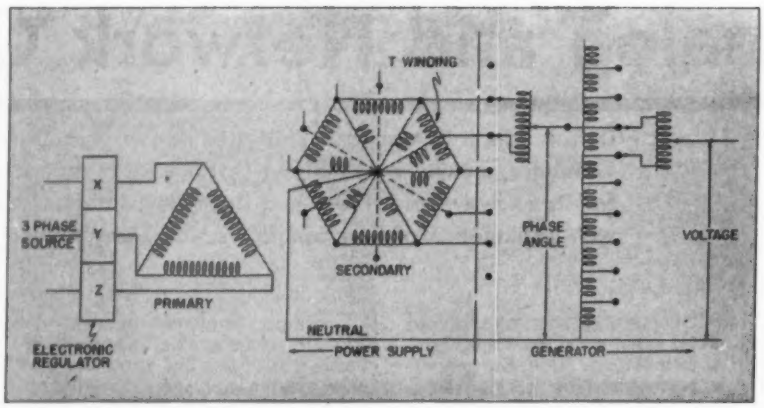


Fig. 5. A schematic diagram of the power supply showing how the 12-phase generator is connected

transformers around the six phases produces 12-phase output which is fed to generator units through distribution boxes in the rear of the computer room.

The 12-phase, 120-volt input to the generator units is connected to the phase angle selector switch which connects an autotransformer across the ends of successive voltage dividers. Since this arrangement gives 325 degrees of knob rotation for each 30 degrees of phase angle, the phase angle of a generator can be controlled very accurately. From this phase angle control, the potential is applied to an autotransformer which is tapped in 20-volt steps up to 220 volts. Here another autotransformer is connected across successive voltage steps to allow fine control within 20-volt increments. This source of voltage, variable in phase angle and magnitude in smooth increments over a wide range, is the board generator.

This brief and elementary description of the Detroit Edison analog and computer, it is hoped, will give those not familiar with these devices, if not a working knowledge, at least some understanding of their purpose and principle of operation. Keep in mind that the analog is really an electrical system in miniature. When low-voltage current is impressed into the system exact measurements can be made to tell what is happening in any part of the system.

There are many refinements which make the operation fast and convenient. Included, for example, is a plotting table. This is a glass table underneath which are installed some 800 miniature indicating lamps. When a line drawing of the system is placed over this glass table, properly registered, little spots of light will show up through the paper, indicating the exact points in the system where measurements are being made. This plotting table was developed by L. B. LeVesconte of Sargent & Lundy and is covered by his patents.

A project of this kind is inevitably the result of the ideas and work of many people. The initial inspiration and fundamental design of the unit is due to J. S. Ambrose of the Detroit Edison Co. J. E. Freer, formerly an associate of the Company but now with E. I. duPont deNemours & Co., contributed a great deal of earnest effort from the early stages of the development to the final design and construction. R. W. Gilbert and the Weston Instrument Co. rendered valuable assistance and permitted the use of an amplifier developed by Mr. Gilbert. Credit also goes to Westinghouse Electric Corp. for permission to use metering, control and circuit selection schemes covered by their patents.

[1] Such an analyzer, using small rotating generators is actually in use by the Électricité de France. This micro-network, as it is called, uses rotating machines possessing the same electrical and mechanical characteristics as the actual machines, and makes it possible to make rapid and advanced studies of *dynamic* stability.

Basic Materials Exposition

INTERNATIONAL EXPOSITION, first of its kind held anywhere, planned to meet the needs of industrial "worlds of tomorrow", by presenting under one roof the whole range of new materials flowing from the laboratories of industry and needed for product development, has been announced by Clapp & Poliak, Inc., New York.

Called "Exposition of Basic Materials for Industry", and described as "a new link in our industrial communications system", by Don G. Mitchell, president, Sylvania Electric Products, Inc., who is chairman of the board of sponsors, the show will be held in New York at Grand Central Palace, June 15 to 19, 1953.

Simultaneously with the exposition, a series of technical conferences will be conducted to discuss the properties and potentialities of the new materials.

Besides the emphasis on new materials, the exposition will demonstrate new uses for standard products, such as wood, metals, alloys, plastics, ceramics, textiles, leather, rubber, cork and glass. Product components and accessories will be featured.

Power Engineering's

PRACTICAL ENGINEER and ELECTRICIAN SECTION

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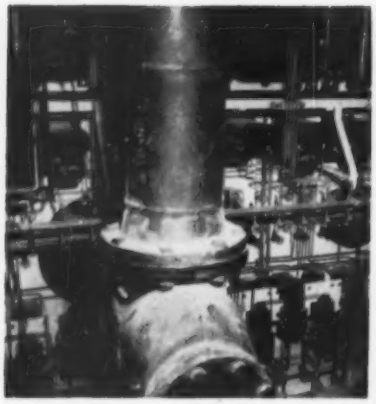


Fig. 1. (above) Back of boiler combustion control panel in Fig. 2. Electric equipment mounted to left

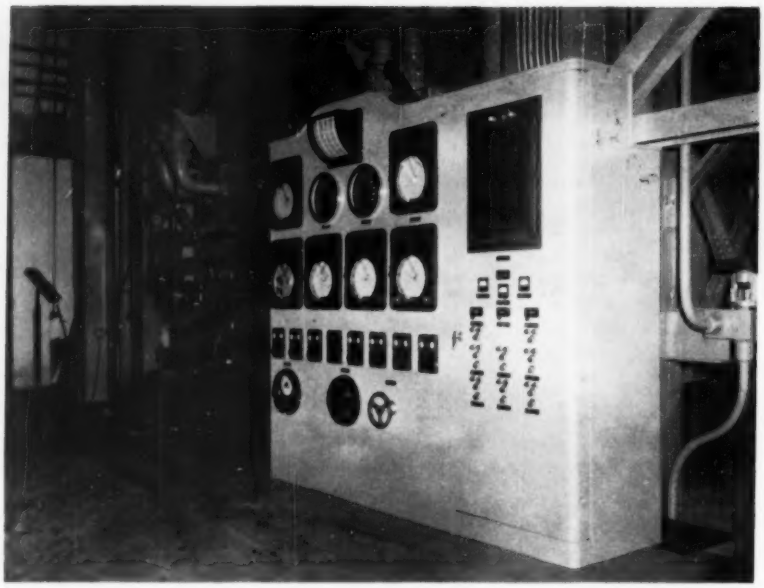


Fig. 2. (right) Boiler combustion control pane at City of Pasadena Light and Power Department

Good Instrumentation Program

PASADENA LIGHT AND Power Department was faced, four years ago, with the problem of converting from hand control on the relatively low pressure units to a fully automatic high pressure high temperature unit. The instrumentation for the new unit had to be designed, ordered, installed, calibrated and put into operation. The operating crew had to be trained and the unit had to be put into commercial operation. At that time qualified instrument men were practically unobtainable.

Faced with the problem of making such a radical change with the existing personnel and with little outside help the Light and Power Department made what proved to be a profitable decision. They picked one of the design engineers who had done most of the preliminary instrument design work and sent him to the Bailey Meter Company's school in Cleveland. Upon his return he immediately went to work supervising the installation of the instrumentation for the new unit.

While this work progressed the same men spent several hours a week instructing the operators on the engineering principles and operation of the new unit. At the completion of the installation two of the best men were picked from the erection group and under the supervision of the engineer did all the instrumentation calibration and testing of equipment and later became the instrument group.

Running equipment and instrument calibration tests is an excellent opportunity to break in operators. Every advantage was taken during this period to give them experience with the new equipment.

For example: When calibrating and setting the two-speed forced and induced draft fans in conjunction with the combustion control system, it is necessary to continually pick up and drop off the load, operating the boiler half by hand and half by automatics, until the transfer switches, relays, etc., are properly synchronized. During these periods of testing the operators get invaluable experience in switching from hand to automatic and back again under all kinds of load conditions.

Once the unit was in full commercial operation of full automatic control it was decided to keep the two men who had calibrated the instruments as a permanent instrument group.

These two men became part of the operating personnel but got their assignments from the same engineer who in turn worked out of the engineering department spending part time in engineering and part time at the plant.

The advantages gained by this arrangement are summed up as follows:

1 — Much closer cooperation between the engineering department and the operating department

2 — The operating department has an engineer close at hand who can be called upon to work on any problems which arise

3 — Top management has first hand factual information on the efficiencies of each piece of equipment and the plant, as continually gathered by the instrument group

4 — All plant instrumentation is calibrated and maintained at a high standard

5 — The information rendered by the instruments is interpreted objectively in the best engineering tradition

6 — Recommendations for changes, additions and improvements are presented to management on a factual dollars and cents basis and after approvals; are worked out in the engineering department with all the practical, on the scene, facts adequately presented.

Because instruments are doing more and more of the control work, either directly or through the information they yield, the calibration and maintenance of these instruments becomes more and more important. In fact, just the slightest readjustment of one critical instrument can make or lose more than the cost of the engineer's salary.

An example of one of the more unusual problems faced and solved by the Light and Power Department's instrument group developed early in the operation of the new high pressure high temperature unit.

The make-up water for all the boilers comes in the form of steam from the city incinerator boilers located about a block away from the power plant. Since the incinerator boilers carried over quite frequently the incinerator steam was condensed at the plant and the condensate sent to storage and analyzed by hand before being used for plant make-up.

After the new unit had been in operation for a short time considerable corrosion was noticed in the

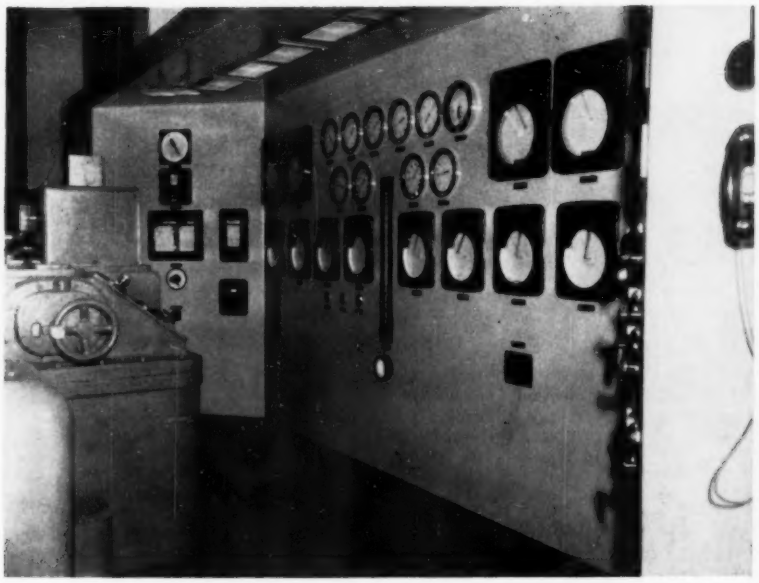
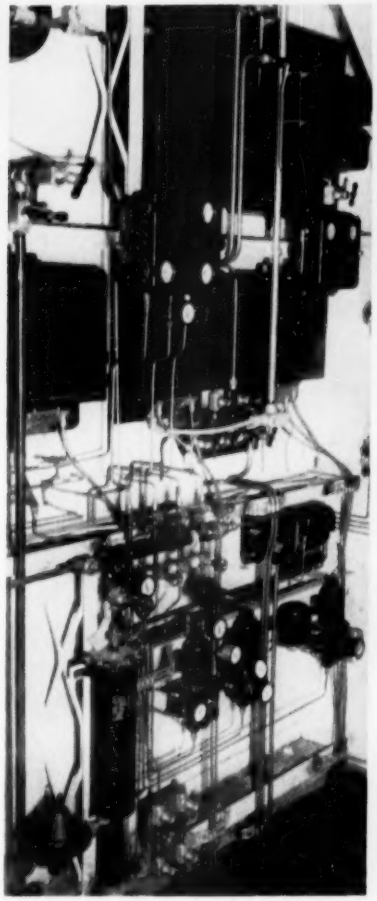


Fig. 3. (at left) The turbine control panel at the City of Pasadena Light and Power Department

Fig. 4. (below) Deaerator control which is mounted on the back of the turbine control panel in Fig. 3



Pays Off

By **CHADWELL O'CONNOR**
Mechanical Engineer
City of Pasadena Light and Power Department

water make-up lines. A check was made of the pH of this water and it was found to be very low, around 6.

This explained the corrosion and the relatively large amount of caustic required to hold the boiler pH up.

The only source of make-up water being incinerator steam the low pH must come from this steam. A check was made and it was found that the steam contained a large amount of CO_2. If this non-condensable could be removed all the water problems would be solved, but the cost of degasifying the steam seemed prohibitive.

The instrument group decided to pursue the problem by learning more about the habits and peculiarities of the incinerator. Due to a bit of foresight the conductivity recorder used for drum water was provided with an extra position. A cell was placed in the incinerator steam line and connected to the recorder which in turn actuated an alarm so that as soon as the incinerator boiler started carrying over the alarm would sound. The purpose of the alarm was to notify the operator so that he could immediately divert the bad water to waste.

It so happened that the conductivity recorder was put into service on a Monday. All day Tuesday there was no alarm. Wednesday no alarm and Thursday no alarm. It was thought that the instrument was not working properly because the steam purity was excellent. Better in fact than could ever be obtained with the evaporators.

On the following Saturday the instrument made up for lost time. The alarm went off regularly throughout the day. On the following Tuesday the conductivity subsided again. It immediately became apparent what was happening and a few simple steps were taken which resulted in a net gain to the Light and Power Departments of at least $750.00 per month. The cost of the instrument which supplied the necessary information was paid off in less than a week.

The analysis and solution of the situation was as follows:

a — The incinerator boilers were emptied Sunday and refilled on Monday for the week's run which ended Saturday night

b — The heaviest firing was done on Saturday —

Therefore carry-over was due to either:

1 — Accumulation of solids in the boiler drums
2 — Overfiring on Saturday
3 — A combination of both

c — Heavy firing on Monday produced no alarm.

Therefore it must be solids. The conductivity of the incinerator drums was taken and it was found that if the solids were kept below a certain point no carry-over occurred.

The supervisor in charge of the incinerator cooperated to the fullest by checking the water and blowing down accordingly. So successful was this operation that the alarm never rang again.

The make-up water got consistently better but there was the one remaining problem. Low pH. The instrument group came up with the answer. Why not deaerate the incinerator steam? Wouldn't this do it?

Now that the incinerator steam was so consistently good it could be introduced directly into the high pressure plant cycle. This was accomplished by introducing the steam directly into the deaerator with the following results:

1 — The pH went up one whole point because most of the CO_2 was removed from the steam before it got into the power plant cycle

2 — The heat amounting to approximately 20,000,000 Btu per hr was used for feedwater instead of being dissipated in the cooling towers

3 — The continuous blow-down and chemical feed of the high pressure boilers decreased to an eligible quantity

4 — So much high quality distilled water was produced that a distilled storage tank overflow was installed which returned distilled water to the incinerator boilers which sweetened their make-up by better than 50 per cent distilled water with obvious results.

Water Treatment Engineering—
Chemicals Used in Water Conditioning

Selection of chemicals for sound water conditioning is based on only two considerations—economy and efficiency. Proper balance between the two is necessary to get the most out of your system

By L. W. FITZPATRICK
Chief Engineer
Department of Corrections
State of Missouri

TWO "E'S"—*economy* and *efficiency*—equally balanced in a perfect equation are practical endpoints for efficient water conditioning. It is possible to have efficiently operated thermal equipment at prohibitive cost from over-treatment; likewise, considerable breakdown and unexpected outage invariably arises from penny-pinching.

The question always arises as to what *is* efficient and economical water conditioning. Based on average plant conditions, assuming an efficient external softening cycle and return condensate system, internal water treatment cost will vary from 8 to 12 cents per 1000 gal of new makeup water added to the system. Thus, actual water treatment cost is but a fraction of a cent for each 1000 lb of steam produced.

An average overall cost of 55 to 60 cents per 1000 lb of steam produced will show that efficient water conditioning inside a boiler to reduce scaling, corrosion and embrittlement, actually represents only a fractional per cent of the entire steam generation cost.

While it has been determined that heat losses due to scale are relatively small, not exceeding 2 per cent, elimination of scale in dollars and cents is the equivalent of raising boiler flue gas CO_2 about 1¼ per cent. It is obvious that 2 per cent additional efficiency is easier and more economical to obtain by correct water treatment than by any other means of increasing boiler efficiency.

In addition, failure of boiler tube surfaces through overheating due to scale is eliminated. In a yearly tabulation, correct water treatment will actually show close to a 4 per cent plant efficiency gain.

Hit-or-Miss Era Over

At the turn of the century water treatment was hit-or-miss, mostly miss. Many boiler compounds were offered to the infant power industry which, because of the lack of research, did little to eliminate breakdown of equipment.

Today, adequate pilot plant and continual research has brought prepared boiler treatment to the front; and the average plant operator, without detailed chemical knowledge and development equipment, relies on an accredited water treatment specialist.

Whether a prepared compound is purchased or a mix is blended in the plant, results are being bought and the price per lb is meaningless. Since water treatment chemicals individually vary from a few cents to more than $2 per lb, net cost of treating each 1000 gal is the criterion. It is decidedly impractical to stretch economy to the point where final results can be impaired. A lower price per lb does not necessarily mean economy since results must balance against money expended in ratio to the amount of water successfully treated.

In the final analysis internal chemical treatment is necessary to handle slight hardness residuals from externally treated makeup introduced into the system through contaminated return condensate. It is also necessary to cope with corrosion entering through accidental oxygen leakage or by small corrosive tendencies of various chemicals used.

While hardness introduced into return condensate may be slight, boiler evaporation and continual concentration can increase it to an appreciable amount. Small residual hardness from softener and makeup points is continually increasing through evaporative concentration.

Selection of Phosphate

Soluble calcium salts which form the bulk of scale are easily treated with sodium phosphates. Simple orthophosphates and complex phosphates are often used; but regardless of the general type employed, reaction with calcium salts is identical as every phosphate reverts to trisodium phosphate in the hot boiler drum. This reaction is completed as phosphate unites with calcium to form a flocculant precipitate, tricalcium phosphate.

Final selection of the phosphate chemical is based entirely on economics and boiler water alkalinity, whether an acid-, neutral- or alkaline-based phosphate should be utilized.

Generally, disodium phosphate is the cheapest way to purchase required phosphate. The material is a neutral-based compound, affecting pH of boiler water very little. Monosodium phosphate, being acidic, is used with success where some reduction is desired in pH. To increase pH in boiler water, trisodium alkaline phosphate is used.

Polyphosphates are useful to prevent calcium carbonate deposits in feedlines, since they remain dormant until an increase in temperature (as in the boiler drum) changes them to trisodium phosphate with the final reaction precipitating calcium as tricalcium phosphate.

It has been found from experience that the shot method of feeding any phosphate is inefficient compared to a continual chemical feeder method, since with the former a relatively high phosphate concentration will be in the boiler for a longer period. Constant feed through a controlled volume feeder is to be desired since phosphate is proportioned to makeup, feedwater flow and boiler loading.

Oxygen Corrosion

Oxygen is the most common cause of corrosion affecting any part of the system, pumps, feedlines, heaters, economizers, boiler drums, tubes, steam distribution lines and return condensate lines. Mechanical deaeration and sodium sulfite will effectively minimize this corrosive agent.

Mechanical deaeration can produce an effluent water with oxygen content as low as 0.006 ppm or less; but it has been found that extremely small amounts, as low as 0.005 ppm or less, can initiate corrosive action.

Table I. Operating characteristics of mechanical feedwater deaerators showing ultimate O_2 content

Type Unit	Operating Press., psi	Operating Temp., F	O_2 in ppm Effluent
Open Htr.	Atmos.	160–210	1.2
Deaerating Htr.	1–5	215–226	0.04
Deaerator	2–10	220–240	0.006, or less

Two types of sodium sulfite (one the commercial grade and the other a special catalyzed grade), when carried in excess of 15 ppm for an open feedwater installation, 2.5 to 5 ppm for a deaerator heater, or as low as 2 ppm following an efficient deaerator, will minimize corrosion in plant water and boiler cycle.

When using either of the sodium sulfites, a rather simple test makes it unnecessary to go through the

Table II. Reaction of sodium sulfite with oxygen

$2\,Na_2SO_3 + O_2 = 2\,Na_2SO_4$
(sodium sulfite) (oxygen) (sodium sulfate)

1 ml/l of dissolved oxygen = 1.43 ppm
1 ppm dissolved oxygen = 0.698 ml/l
Each 0.01 ml/l dissolved oxygen = 0.014 ppm = 0.001 lb per 1000 gal of sodium sulfite for removal

Table III. Typical organic compound to be used with phosphate treatment for boilers under 450 psi

Organic compounds	70%
Inorganic compounds	25%
Moisture	5%
pH of 5% solution	10.0

Composed of specially processed tannin and sodium lignin organic compounds with added stabilizing inorganic materials.

Table IV. Typical commercial sodium polyphosphate-organic boiler treatment for up to 2100 psi

Phosphate content	54%
Insoluble material	1%
pH of 5% solution	8.2
Solubility at 75 F (parts of water)	0.16
Na_2O/P_2O_5 ratio	3/2

Miscellaneous organics including lignin derivatives containing carboxyl and phenolic hydroxyl, with added antifoams, corrosion and embrittlement inhibitors.

Table V. General organic, phosphate and domestic boiler formulae. Four domestic blends are listed

General Organic Blend Formula

Soda ash	5–15%
Chestnut tannin	70–75%
Sodium polyphosphate	7–13%
Polyamide, polyhydric antifoam	3– 7%
pH of 1% solution	7.4–8.0

Phosphate Blend Formula

Anhydrous disodium phosphate	75%
Corn starch, powdered	25%

General Domestic Boiler Formulae

	%	%	%	%
Soda ash	25	25	25	5
Disodium phosphate	25	25	25	10
Sodium sulfite	30	30	30	30
Sodium polyphosphate	5	0	10	10
Sodium nitrate	15	0	0	0
Chestnut tannin	0	20	10	45

time consuming and difficult oxygen test. It can be safely assumed that, when this test shows a proper excess of sodium sulfite, oxygen content is practically zero. Sulfite usage is a good investment in every plant since it provides perfect indication of efficient operation of deaerating equipment. A sudden increase in the dosage to maintain the specified residual will show deaerator efficiency has fallen off.

Organic Materials

Organic materials have been the most abused chemical agents since it was discovered that once calcium and magnesium salts have been precipitated as a sludge, it was necessary to maintain this sludge in a fluid form.

Most organic materials are difficult to control. Their dosage must be determined solely on expected calcium and magnesium precipitation.

Lignins, tannins, starches and seaweed compounds and their derivatives are usually employed; and, being complex chemical structures, they are hard to identify chemically. In their natural state they are generally semi-soluble in water. Upon boiling, another portion of the compound dissolves and the remainder forms a gelatinous floc which absorbs suspended precipitates.

All organic agents exert a coating action on precipitated inorganic solids which measurably decreases their tendency to adhere to metal surfaces. Proper organic concentration will range from 2 to 10 ppm for stabilization of water, and between 4 and 20 ppm for sludge conditioning and corrosion control. These dosages are dependent on analysis of water used, hardness content and eventual precipitation formed. Whatever type organic compound is used, the purpose is to form a fluid boiler sludge which will remain in suspension for final removal by blowdown.

Many organic materials possess definite oxygen removal characteristics, but since organics are controlled on the basis of scale and sludge and the quantity used is fixed by these requirements, it is more economical and efficient to rely on sulfite for oxygen control because of the simple and effective sulfite test.

Most organic compounds offered on the market generally contain added corrosion inhibitors, antifoam agents and embrittlement inhibitors.

While many steam plants are not unduly troubled by return condensate line corrosion, pH of the condensate should always be maintained in the range of 7.2 to 7.5. This is easily accomplished by addition of an alkaline material that will volatilize with the steam. Generally known as amines, these compounds readily volatilize forming a gas, and consequently go wherever steam does. They are easily fed into boiler water, carried over in steam, to dissolve in the condensate and recirculate.

Dosage of amines is small. In addition to protecting piping, considerable maintenance will be avoided since amines remove corrosion products from traps and strainers, reduce plugging of strainers and regulators.

Removal of this plugging material will often reduce overall steam consumption since blow-by of traps is sharply cut if seats remain clean of all deposits. It is not unusual after the addition of an amine compound to a steam system to produce a saving of more than $7 for each dollar of amine material used. This saving is reflected in reduced labor, maintenance, pipe replacements, trap repairs, as well as lowered steam demands.

Whether purchased on the market or blended in the plant, every boiler compound should be carefully studied to see that it will perform every function necessary for successful water conditioning. Absence of one necessary action will sharply reduce the prime function to promote clean and non-corroded metal surfaces in the plant steam cycle.

"Chief, I'd like a few words with you about that condensate pump!!"

How to Figure Pressure-Temperature Equivalents Mentally

You're out somewhere in the plant, with no steam tables handy and you want to know how high the saturated steam temperature is where a gage is showing the pressure. Here's how you can figure it quickly, and close enough for most practical purposes

By LUCIEN R. GREIF
Instructor, City College of New York

HAVE YOU EVER been stranded on a South Sea Island with only the proverbial blond, and *no steam tables?* And you simply had to know the saturation temperature for a given pressure? Probably not . . . but perhaps you have sometime wished there was an easy way of mentally figuring an unknown pressure from a known temperature, or vice versa. If you have, this method may help you.

First of all, there is a very definite mathematical relationship between the two quantities. Using values given in Keenan & Keyes, *Thermodynamic Properties of Steam*, we may plot temperature (deg F) versus pressure (psia). Result is shown in the curve. From this graph it becomes apparent that the formula relating the properties must be some sort of exponential function; something like $t = Ap^B$, where t is the temperature (deg F), p the pressure (psia), and both A and B constants to be determined. Trial and error fixed these at 116 and 0.224 respectively, yielding Equation 1, below. Its accuracy is within a few degrees of values listed in the steam tables.

$$t = 116\ p^{0.224} \qquad \text{(Equation 1)}$$

Now, using a slide rule, and assuming you can remember the equation, you can calculate either t or p if the other is known. However, this still is not of too much value out in the field where you generally don't have a slide rule along. For such cases Equation 1 may be approximated by Equation 2, which gives surprisingly close answers.

$$t = 100\ p^{0.25} \text{ or } = 100\ \sqrt[4]{p} \qquad \text{(Equation 2)}$$

In words, this may be stated as follows: temperature is equal to 100 times the fourth root of the pressure. And, of course, the fourth root is the square root of the square root, all of which can be figured mentally with adequate accuracy. This is best illustrated by means of an example. For a boiler generating saturated steam at 900 psia, what is the temperature?

Step 1: Square root of 900 is 30.

Step 2: Square root of 30, say 5.5.

Step 3: 100 times 5.5 is 550, and that is the approximate temperature.

Incidentally, using Equation 1, the answer is 532 F, while the saturation temperature listed in Keenan & Keyes is 531.98 F. Similarly, nearly exact and approximate results are obtained for other values, as shown in Table I.

The same equations may naturally be used in reverse to find corresponding pressure for a known temperature. For exact values use Equation 3.

$$p = \left(\frac{t}{116}\right)^{4.47} \qquad \text{(Equation 3)}$$

Or, for a fairly close approximation, use Equation 4.

$$p = \left(\frac{t}{100}\right)^{4} \qquad \text{(Equation 4)}$$

Thus, if we know the saturation temperature is 500 F, the pressure should be something like 500 divided by 100 multiplied by itself four times (i.e., $5 \times 5 \times 5 \times 5$, which is 625). Equation 3 yields a value of 685.9 which compares favorably with the one of 680.8 listed in the steam tables. Additional computed values are tabulated in Table II.

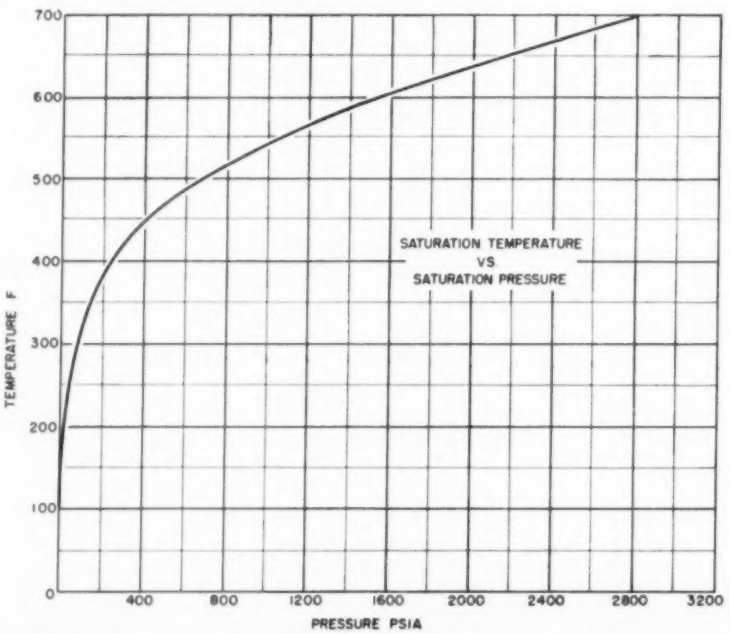
Both Tables I and II show that the equations yield satisfactory results over the entire range of saturation temperatures and pressures. Slight divergence between the calculated and listed values may be eliminated by a refinement of constants A and B to four or five significant figures. However, because for most operating conditions the calculated values are certainly close enough, and because repeating digits are easier to remember, given constants were chosen.

Table I. Comparison of some calculated temperatures from Equations 1 and 2 to steam table values

Known Pressure, psi	Saturation Temp., F Equation 1	Saturation Temp., F Equation 2	Saturation Temp., F Steam Tbls.
14.696	212	196	212.00
50	278	266	281.01
100	325	316	327.81
500	466	474	467.01
1000	545	563	544.61
2000	637	670	635.82
3000	696	740	695.36

Table II. Comparison of a few calculated pressures from Equations 3 and 4 to steam table values

Known Temp., F	Saturation Press., psia Equation 3	Saturation Press., psia Equation 4	Saturation Press., psia Steam Tbls.
100	0.5148	1	0.9492
200	11.41	16	11.526
300	69.87	81	67.013
400	253.7	256	247.31
500	685.9	625	680.8
600	1548.0	1296	1542.9
700	3086.0	2401	3093.7



Temperature (F) plotted against pressure (psia) gave this curve, using values found in steam tables

Editor's Note:—You should try to remember a few approximate values, such as: 500 psi, 467 F; 1250 psia, 572 F; 3206 psia (critical pressure) 705 F, highest possible saturation temperature.

Metallizing Salvages Pistons

A WEST VIRGINIA machine shop reports on an interesting metallizing job involving the salvage of compressor pistons for a large chemical corporation. Rods are $5\frac{1}{4}$-in. alloy steel and wear $2\frac{1}{2}$ ft on either side of the centrally located 19-in. pistons.

Here's how the job was done. The rods are first turned down approximately 0.10 in. on the radius, threaded with a fine U-type thread and then prepared with a special surface roughing tool, which produces a surface somewhat similar to knurling.

The prepared surface is then sprayed with a special stainless alloy to about $\frac{3}{32}$ in. over the original diameter. Rod is then ground to required dimension.

Replacement cost for these piston rods runs about $1000 to $1200 each, with delivery very uncertain. Metallizing puts a unit back in service in two days and costs about $250.

The chemical corporation for whom this work was done states that a rod with a metallized surface is superior to the original rod. Its useful service life is greater and the packing wears longer. As a result of these advantages, they now have new pistons and rod units metallized before installation.

Metallizing a piston with special stainless steel alloy. The alloy is sprayed on the prepared surface

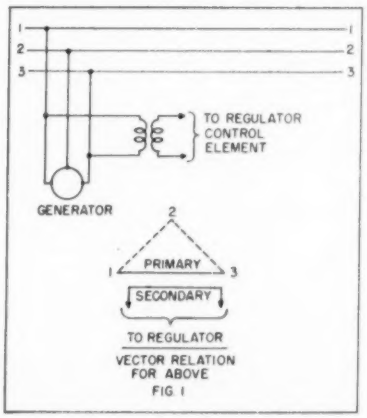
Potential Transformers on Voltage Regulators

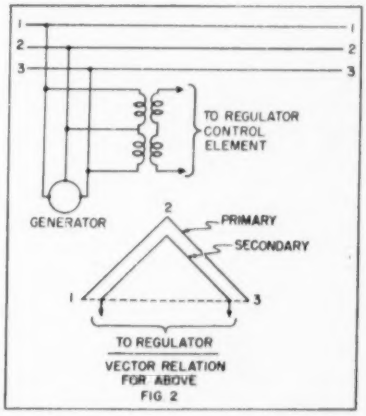
By C. O. VON DANNENBERG

AFTER the past 50 years of application, it seems odd to find many 3-phase generator installations so arranged that the regulator may give poor service under fault conditions. Fig. 1 and 2 indicate this clearly.

The connections in Fig. 1 show only one potential transformer connected to lines 1–3 so that the response of the regulator is limited to the change of the voltage from this portion only and at time of trouble or variation of 1–2 and 2–3 remains unaffected. This condition will of course give unsatisfactory voltage control for system.

The connections shown in Fig. 2 which include two potential transformers, connected 1–2, 2–3 and regulator element connected to 1–3 will be responsive as is clearly indicated, by a change between any lines and will therefore give control for any line-to-line change. This is desirable for the average system which is rarely balanced completely.





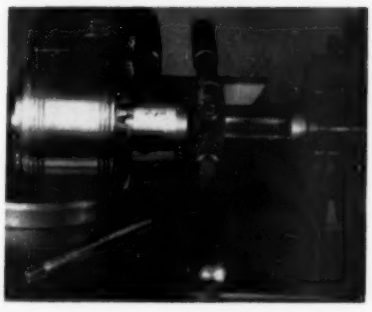
Safe, Fast Lathe Tapping

By F. E. RILEY

WHEN PERFORMING general tapping jobs in engine lathes, it is a common practice to insert the screwed end of the tap into the mouth of the hole to be threaded, and to support the shank end of the tap by means of the lathe tailstock center which engages the center hole in the tap end. A standard tap wrench is engaged with the flats at the end of the tap shank. With the spindle and the work revolving under power, the operator feeds the tap into the hole by means of the tailstock barrel. Great care is required to keep the center up to the tap as it feeds itself into the work. If the center should lag behind and come out of the small center hole in the tap, it is probable that the tap will be smashed, or the work pulled out of the chuck.

By grinding a pair of flats into the shank of a standard tap, close to the end of the thread, it is possible to dispense with the tailstock center and to obtain great safety and support for the tap.

The two new flats are engaged with



Rear view of engine lathe showing tap shank in tailstock chuck. Modified tap in foreground

the ordinary tap wrench, to prevent rotating, and the handle of the wrench rests on any suitable piece of material held in the tool post. With the wrench on the flats, the tap shank projects to one side and this may be gripped in the lathe drill chuck which is mounted in the barrel.

Support for the tap shank is now provided by the drill chuck jaws. The tap shank is gripped lightly by the jaws so that accurate following of the tap as it screws its way into the work is not necessary; it can slide axially in the chuck, if necessary, while being supported thoroughly the whole time.

Tap shown in the foreground of the illustration has been modified by provision of two extra flats ground at the thread end. Two flats, adjacent to one another, as shown, are adequate for holding the tap against turning torque of the work.

Owing to the additional safety of this method, it is possible to rotate the work at a greater peripheral speed — more in keeping with the true and efficient cutting speed of which the tap is capable. Holes are tapped much faster and the operation of substituting the tailstock center for the drill chuck, after drilling the hole in the work, is eliminated entirely.

Train Night Watchmen to Check Boiler Water Gages

OWNERS OF MANY small and medium-sized plants consider one of the chief advantages of a completely-automatic boiler is the fact that it can run itself and provide steam for light loads during the night when the plant is shut down. This saves expense of hiring a night fireman. In his place the watchman is instructed to look at the water level and pressure gage when passing the boiler on his rounds, and to call the day engineer if things aren't normal.

But watchmen, in most cases, are not trained boiler operators. Judging by some of the boiler accidents that happen while watchmen are in charge, it seems that some have not been sufficiently impressed with the importance of giving close attention to the boiler *every time* they visit the boiler room on their rounds.

Most watchmen cannot be expected to recognize all types of unfavorable operating conditions and prevent all boiler failures. But low water, particularly when it occurs in a fire-tube boiler that is operating at a very low rating, can usually be detected long before any damage is done. If the feed pump or return pump fails, for example, several hours may pass before enough water has been evaporated to reduce level to the danger point. The gradually worsening situation shows up in the water gage glass in ample time to prevent damage to the boiler.

Of course, controls for an automatic boiler include a low water cut off and this device should, and usually will, shut off the burner or stoker when low water develops. But automatic cut offs are not infallible, so the watchman should fully understand the importance of the water gage glass and the consequences of ignoring it. The point was illustrated in two accidents that happened within recent months, according to *The Locomotive* of The Hartford Steam Boiler Inspection and Insurance Co.

Recent Accidents

In one case, the boiler involved was a new, package-type unit, oil-fired. It was damaged as a result of low water after the motor-driven feed pump stopped when its relay was tripped by low voltage on power lines leading to the plant.

Power company records showed that the low voltage condition happened 5 hr before the boiler was damaged. It is obvious that there had been plenty of time to observe lowered water level in the gage. In addition, a signal light on the boiler control board showed the pump was not operating, making it quite apparent that the watchman had not given much attention to the boiler on his rounds.

That the low water cut off had also failed was indicated by the fact that the burner was still running when the watchman discovered steam blowing from tube ends of the overheated boiler. But the cause for failure of the cut off could not be determined. No fault could be found in the device or its connections, and it worked perfectly on repeated tests made after the accident. It was finally assumed that binding or stiffness in some part of the new mechanism had prevented it from operating.

Second case also involved an oil-fired, package-type boiler. It was damaged due to low water while operating on special, low-pressure controls used for the night load.

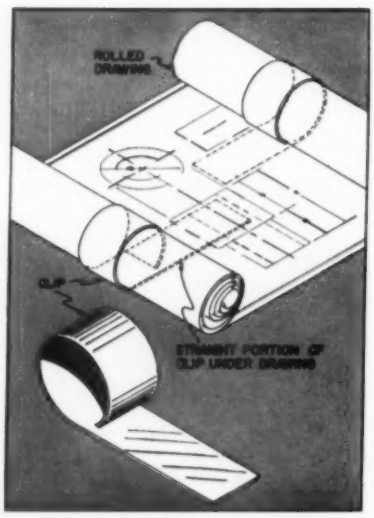
The watchman did not notice anything amiss until he discovered the boiler was badly overheated. The damage was so severe that a new furnace, new tubes and a new rear head were required for repair.

In this case, the feed pump had stopped due to a short circuit at the control board. Exact time of this failure could not be established but, because the boiler was carrying a very light load, it is apparent that several hours elapsed before water dropped to an unsafe level.

As far as the low water cut off was concerned, it had been tested by the engineer the day before the accident and functioned satisfactorily. But, in the meantime, the mercury tube had become disengaged and did not tilt with the switch mechanism to shut off the burner when the low water condition developed.

Clips Ease Handling of Rolled Drawings

By F. E. RILEY



Clips made to keep rolled drawings flat

PLANT LAYOUT drawings are generally of large size and often stored in rolls for easier transportation. Very often, only a small section of the drawing is to be referred to at one time. In this case, weights of various kinds usually are placed on the drawing to hold it flat. Any shifting of weights allows the drawing to roll up tightly like a roller blind, and the exasperating search for that portion being studied begins again.

I have gotten over troubles associated with rolled drawings by making a pair of sheet metal clips, each of which is curled over at one end to an almost complete circle. Clips are about 10-in. long on the straight portion and about 2½-in. in diameter at the curled end. Ordinary galvanized 16-gage sheet steel is used, and the strips are about 3-in. wide.

By arranging the drawing so that it forms two equal rolls as shown in the sketch, a clip can easily be placed on each roll. When referring to the drawing, it is laid on a flat surface with the clips in place. By moving either, or both, of the clips any part of the drawing can be held flat and firmly in position. Such an arrangement takes only small table space.

Icelandic Power Projects

TWO MAJOR hydroelectric power plants now under construction at Sogsvirkjun and Laxavirkjun, Iceland, will be equipped with Westinghouse generators capable of producing nearly 41,000 kw. The projects are scheduled for completion late next spring.

Sogsvirkjun station, located at Iru Falls on the Sog River, will provide electric power for householders in the capital city of Reykjavik, some 32 miles away, as well as power for a 6000 ton-a-year nitrogen phosphate fertilizer plant now being built in that city.

Electric power is especially in demand by Iceland's housewives because of the lack of wood and coal on the island.

Laxavirkjun station is being built at Bruar Falls on the Laxa River in the northeastern section of the country. An 8600-kw generating unit there will supply power to Akureyri, an important textile and fishing center.

At Sogsvirkjun, two 15,650-kw water-wheel generators will be housed 115 ft underground.* Water for the turbines will flow through two natural penstocks cut vertically in lava rock. After leaving the turbines, the water will pass through a channel cut beneath the river and discharge downstream.

Welds on steel penstocks for the new Laxa station are being inspected with the aid of a 150-kv industrial radiographic x-ray unit, which later will be turned over to a hospital in Akureyri for superficial therapy work.

* See article Iceland Builds New Hydroelectric Plants Underground, POWER ENGINEERING, November, 1951.

Spooks and Gremlins in Our Power Plant

By A. E. RICHARDS

HALLOWE'EN with its spooks and gremlins and eerie happenings came around this year as usual. The next day one of our big 14-in. circulating pumps slowed down to a mere canter and refused to push its share of hot water. Booster nozzles on the turbine failed to produce desired rpm with inlet and outlet pressures perfectly normal, no appreciable overheating of water-cooled bearings. Careful checkover produced the fact that pump casing was considerably hotter than hot water being handled, indicating friction on impellers.

On lifting that half-ton of casing, the ghost walked, all right!! Split sections of a 2 x 4 in. scantling about 20 in. long were wedged and partially bent around the curve of the impeller wheel, fate being kind enough to locate it in the upper section, else the whole darned pump would need to be dismantled.

You tell me how a 2-ft piece of timber can get into a sealed system! Only one way. When these hot water lines and steam mains were installed, there was no steam or air pressure on the job to give a good blowing out of each length before welding. You'd have to have quite some volume to blow out a 14 in. line. Hence any foreign matter was enclosed in the line as a matter of course; and now, after two or three years in seclusion, reaches the limelight.

Almost the same condition was found some time ago in condensate trap strainers; fairly digested pulp was removed from the strainers and proved to be spruce wood. How long it takes steam at about 325 F to emulsify wood small enough to pass through a steam trap I can't say, but it was well along in the process.

Another occurrence, more understandable this time, was the recovery of a quart of molding sand from two traps following ironer rolls on a big machine. This unit had given some little trouble in getting sufficient heat to iron properly. The laundry superintendent thought that 80-lb steam was not hot enough for his job and wanted full boiler pressure available at 135 lb. These rolls do not revolve, being highly polished stainless steel; the cloth is drawn over them by revolving rolls and smoothed in the process.

Since molding sand is used to fill the whole roll during its fabrication, with only a small outlet at each end for steam in and out, it is easy to visualize some sand sticking to interior surfaces, in spite of a real effort to blow it out. No hammering is permissible, of course, on smooth surface of the bore in loosening its contents. So it is quite in order to expect a fair coating of rather impervious mixture on lower curve of each roll.

We tried piping steam outdoors in an effort to blow these units free, without much result. Will some kind brother engineer advise how this fine sand can be voided, please? Or how much actual hindrance might be expected to transmission of heat through it to the outer surface? We have installed some traps with rotating bucket and some improvement in trap outages, but have found sufficient mud in some cases to prevent rotation or discharge.

Enter Gremlins

Now we come to the gremlins. Makeup feedwater is not metered and amount of city water added can only be estimated as about 10 per cent. This contains about 7.5 ppm dissolved oxygen. All condensate and makeup passes through deaerating heater after which there remains only a trace of oxygen. Boiler feed, boiler contents, main steam headers show pH to 6.5, CO_2 15 to 30, O_2 a trace. From there on through 2000-odd feet of mains, conditions progressively change. At 500 ft distance, samples show CO_2 8 ppm, O_2 1.7 ppm; further on O_2 has risen to 2.2 ppm.

This means that the steam and condensate must be acquiring oxygen in their travels and losing carbon somewhere. It came to our attention through leakage at drainage points where moisture is removed by traps. The nipples from mains in several places started to blow steam, after about 30 months' service. On removal they showed thinning of the iron until you could see through threaded section and occasionally holes through body of nipple. From there right through the whole system back to the condensate returns tank, evidence of erosion or corrosion is plentiful, also progressive slightly increasing of dissolved oxygen.

Suggestion was made of electrolysis taking place at leakage points, and cannot be ruled out, off-hand.

Is It Electrolysis or O_2?

Different materials used in draining mains and other units such as iron to brass, iron to copper and vice versa, can cause electrolytic action, they do say, and certainly those precise conditions exist. An iron nipple with brass or copper valve, nipple, elbow, nipple, trap containing brass or copper bucket, ditto orifice, iron again to pump.

Again, we had two big check valves on receiving end of condensate system just before pumps which elevate it to open feed-water heater. These consist of brass checks guided and held in place by cast-iron clevises a good half-inch thick.

Checks were not functioning properly and on dismantling it was found that the cast iron was almost entirely eaten through, in fact clean through at three places.

I've heard of and seen blocks of zinc anchored inside boilers, ostensibly to absorb any electrolytic action present. Our boilers are in perfect condition, contents and feedwater too, and zinc blocks would be superfluous jewelry there.

But how would one place a zinc plate in welded-up headers or mains and would it be any help? I'd be very glad to hear from any engineer who has had this trouble or found a cure for it. Deep pitting of nipples and piping is evident as well as surface interior erosion at threaded sections. The pitting compares in appearance with worm-eaten portion of an apple, as if an erosion worm had eaten its tunnel through the actual body of metal.

Who is the culprit, Electrolysis or Oxygen or both?

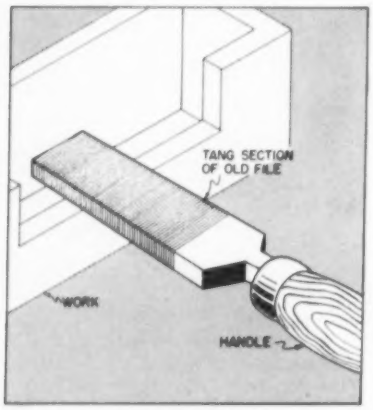
PRACTICAL HINTS AND KINKS

How about the gadget you made or the trick you used to do your job better? Write us about it. Send a sketch too. You will be paid well for contributions.

Salvaging Old Files

By CARL THOMAS

SHORT FILES for use in confined locations can easily be made, as shown. About three-quarters of a length of a worn-out file can be broken off, and the end of the remaining piece squared by grinding.



Short file can be made cheaply from worn-out one

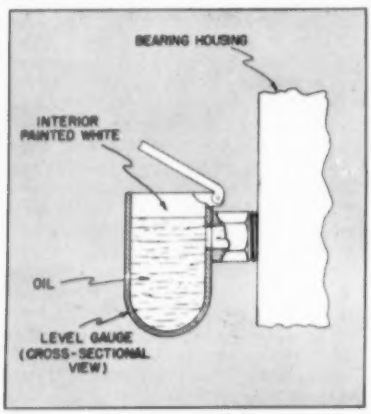
Usually the teeth on the tang end of a file are not worn as much as the remainder of the file; hence, a sturdy, short file with a comfortable handle and sharp teeth. Cost is little or nothing, depending upon the handle.

Good Visibility in Oil Gages

By JOHN FOSTER

BY PAINTING the entire interior surface of the oil level gages used on bearings with white oil proof enamel or paint, as shown, the level and condition of the oil can more readily be seen, especially where the illumination is poor.

Cross-sectional view of painted oil level gage



What to Do When You Lose Ignition

You have been firing pulverized coal, oil or gas in your furnace without any trouble. Suddenly you lose your ignition. What emergency procedure do you follow to get things going again? Many of you know exactly what to do, but as a reminder here is a safe procedure:

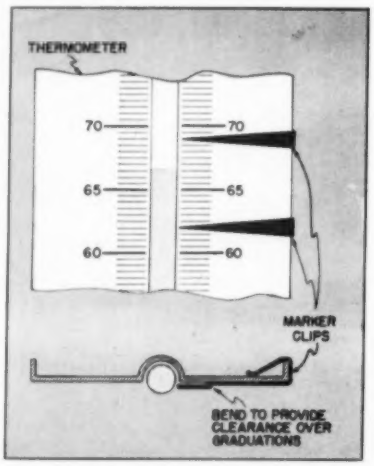
1. Stop all fuel to furnace. Shut off pulverizers and feeders.
2. Stabilize air flow and place damper control on manual.
3. Establish air flow required for purging setting of all explosive gases or fuel.
4. Make sure of feedwater supply and keep water in boiler.
5. Close all dampers but those required to assure air flow for purging setting.
6. Make sure that all electrical switches are in proper position to avoid accidental starting up of equipment.
7. When purge period is complete insert oil lighter in burner and light this burner. Make sure that pulverized coal or other fuel does not enter any burner except the one in which a light-off is present.
8. Light off additional burners as required to hold load.
9. When steam pressure reaches its normal value place all controls on automatic and restore normal operating conditions.

Indicators for Thermometers

By THOMAS TRAIL

A PAIR of simple markers, made of springy metal, as shown, can be used to mark the correct indicating range which it is permissible for a particular thermometer to show. This makes it necessary only to note whether the thermometer indication is within the marked area, not necessarily its exact indication.

Front and top view of thermometer indicators



Transformer Maintenance Hints

Transformers require less care and attention than almost any other kind of electrical power apparatus. This, however, is not a reason for neglecting them. The conditions under which they operate will determine to some extent the frequency with which they should be inspected.

The oil should be tested for dielectric strength and the presence of sludge. If there is an indication of moisture or sludge formation, the oil should be tested further and treated as described later, or in the manufacturer's instruction book. If tests show the oil to be in bad condition, an inspection should be made of the inside of the tank for possible cause of the trouble. However, if the oil tests satisfactorily the case should not be opened but a careful inspection of all accessories should be made to see that they are functioning properly.

Any symptoms such as unusual noises, high or low oil levels, rupturing of relief diaphragm, etc., should be investigated at once.

Any increase in operating temperature at normal load should be investigated and if the cause cannot be determined the transformer should be taken out of service and given a thorough inspection.

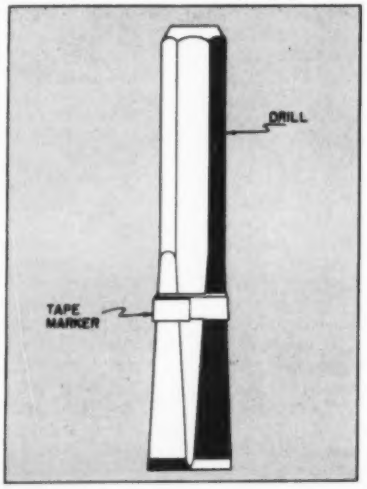
Transformers which have been subjected to unusually severe operating conditions such as overloads, or frequent short circuits, and special units such as furnace transformers should be inspected internally at least once a year. This can usually be done adequately by lowering the oil level and inspecting with a light through the manhole.

Masonry Drill Marker

By CARL THOMAS

ADHESIVE or friction tape wrapped around a hand or power masonry drill, as shown, will conveniently mark the depth to drill each hole. Necessity of repeatedly measuring depth to which the drill has penetrated is thus eliminated.

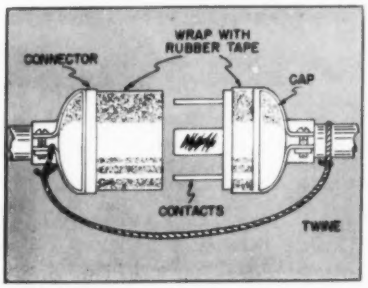
Friction tape will serve as a depth-gage on drill



Cord Cap Protector

By THOMAS TRAIL

CAPS on the ends of portable electric cords, portable tool cords, and the like are subject to rough service, resulting in bending and breakage of the contacts. To help prevent this, a cord connector may be kept attached to the end of the cord, as shown, and snapped onto the cap when the cord is disconnected from an electric outlet, to serve as a protector for the cap



Cord cap protector with cap wrapped with tape

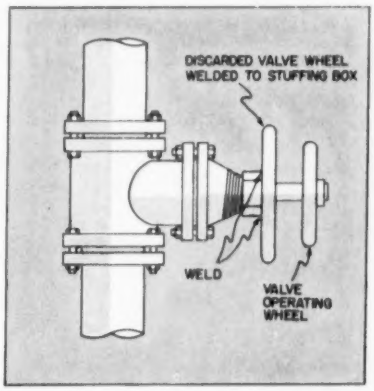
contacts. A few layers of rubber tape wrapped around the cap and around the connector will help provide additional protection from breakage caused by hard floors.

Ammonia Valves

The stuffing boxes of valves used on ammonia lines must be kept tight to prevent the escape of the gas. Therefore, whenever a valve is opened or closed the stuffing box must first be slackened so the valve wheel can be turned, then tightened again afterward. The stuffing box is usually loosened and tightened with a wrench.

To eliminate the necessity of using a wrench, and the consequent danger of its slipping and causing injury to the user or the equipment, a valve wheel can be welded to the stuffing box, as shown in the accompanying sketch, so that it may be slackened and loosened simply by turning the wheel.

A wheel from a discarded valve may be used. The wheel should be larger than the valve operating wheel, both to provide sufficient leverage to tighten the stuffing box and to enable a large enough hole to be drilled through the center or hub so that it will easily pass over the valve stem. The stuffing box should be removed from the valve for welding and care should be exercised to avoid damaging it by heat.



Discarded valve wheel welded to stuffing box

Questions and Answers

Your fellow engineers will answer your power engineering questions.

You answer theirs, get paid well. Simple? Effective? Why don't you try it?

Answer No. 501

Why Do These Steam Flows Differ by 20%?

I BELIEVE the answer to the problem is simply that the accuracy of any meter depends on the range in which it is working. Since the flow is proportional to the square root of the differential pressure the actual differential obtained at light loads is very small and it is difficult to measure it accurately. An orifice designed to give a differential pressure of 2 in. at a certain load will create a differential pressure of only 0.02 in. at 10 per cent of that load. In some meters there is no attempt to measure the first 10 per cent.

Thus if meters are properly installed under suitable conditions they should measure a flow within plus or minus 2 per cent error from about 25 to 100 per cent capacity.

WM. E. ENGELMANN
Edwardsville, Ill.

Answer No. 502

What Has Been Your Experience With Fuel Oil Sludge Solvents?

Use Money to Better Advantage

THERE IS much discussion pro and con on this subject. It seems as though a corporation with more than 100 steam plants scattered about the U. S. and Canada would be in a good position to evaluate this fuel oil sludge solvent problem. This corporation does not use any. Why? Because it has never had to. Boiler efficiencies vary in each plant and between plants, of course, but average efficiency for all Bunker C oil-burning plants for a recent year was 80 per cent.

Much depends on conditions in a particular, individual plant. Don't let the sludge solvent (and soot eradicator) salesmen worry you. Chances are you can use the school's money to better advantage elsewhere about the plant.

Ashland, Mass. G. F. S.

No Solvents, No Trouble

IN REPLY to N. C. A.'s question, we have been burning No. 5 and 6 fuel oil for the past five years — averaging about 2,000,000 gal per year. We do not use any fuel oil solvent or sludge remover in our tanks and have experienced no trouble.

It is my opinion that fuel oil sludge forms in the bottom of the tank for two reasons: (1) General settling of heavy residuals; (2) Water being present. If the tank is agitated, water kept to a minimum, and no heat applied except when oil is in motion, we have found it unnecessary to use a fuel oil treatment.

We accomplish this by doing the following: recirculate and unload oil into the bottom of the tank, and by the use of spot heaters. We turn them off when not burning oil. We have used about 5 gal of fuel oil treatment to clean out oil lines and oil heaters at the beginning of the season. We have found this to be cheaper than dismantling equipment. Albert Lea, Minn. L. R. ANDERSON

Answer No. 503

Why Does This Switch Blade Arc?

IN THE NOVEMBER issue J.A.K. described his electric generating and distribution system and a problem he has when he tries to open a disconnecting switch. The switches are the individual blade type and are not gang operated. Diagram next page.

With switches 1, 2, 3 and 4 closed, no difficulty is experienced in opening switches 1, 2, or 3 a blade at a time, or if any one of them is open, no difficulty is experienced in closing it one blade at a time.

However, with switches 1, 2 and 3 closed, two blades of switch 4 may be opened or closed with no difficulty, but when an attempt is made to open or close the third blade of switch 4, violent arcing occurs accompanied by serious generator and system disturbances. What causes this?

von Dannenberg's Solution

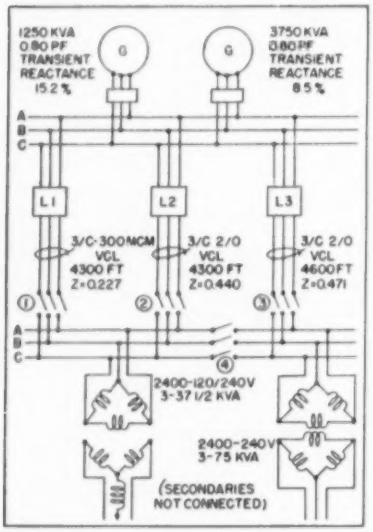
A complete answer cannot be given in the absense of complete information, but the possibilities and reasons causing the disturbances described concern details of much practical value.

Reviewing the diagram, it is noted transformer banks -A- and -B- do not have their secondaries connected,

so for the purpose of our discussion it can be neglected so far as effect on its existing connections are concerned.

Assuming the two generators are connected to a common bus closely adjacent they can be considered feeding the system network as a unit. Since all the feeders indicated are 3-conductor cable, the value of resistance (R) for each cable is greater than the value of reactance (X), it is necessary to calculate the value of impedance (Z), the total resisting value of each cable by taking into account both of these factors.

It is clear that all three cables feed the load in parallel, but since there are two sizes and the one fed through breaker L-3 is direct, while the section fed through L-1 and L-2 is a combined parallel feed, the total current flowing under normal operation



with all blades of switch group 4 closed will be greater from I than from II. These values as calculated indicate the following:

L-1 = 50%, L-2 = 26%, L-3 = 24%.

Hence by adding L-1 and L-2 we find that 76 per cent of the total current passes through I.

If then we begin opening blades, one at a time at switch group 4, the first opening and possibly the second opening will not create much change since the delta connected transformer winding at bank "B" permits a partial feed through I for the conductor connected to the closed blade by way of L-1 and L-2 in parallel. At the same time, however, when we begin opening blades at switch group 4 more current is forced through II and being very much higher in impedance than the combined L-1 and L-2 paralleled value causes a higher voltage drop through II and as follows a high difference of voltage (potential) at switch group 4, particularly when the last blade is opened or the first one closed. What this value of potential might be cannot be stated in the absence of specific load information.

As a final statement the practice of opening a disconnecting switch under load cannot be condemned too emphatically. If operating conditions require such procedure it might be accomplished, perhaps, by operating all blades of group switch 4 as a gang, although under appreciable load even at 2400 volts, as the writer has learned through actual experience, the blades can be opened but arcs will carry over between the sections resulting in damage to the switch, arcing between lines or to ground and causing complete circuit interruption. While there are available air break switches with horns to take off the arcs formed at time of break, the actual interrupting ability is uncertain due to atmospheric conditions, particularly with a wind blowing at a right angle to opening sections.

Brooklyn, N. Y. C. O. VON DANNENBERG

Chmel States —

IN ANY SYSTEM such as J.A.K. has, a transition from one stable operating condition to another stable operating condition will produce transient effects due primarily to the inductive reactance inherent in such a system. If the transient current is of sufficient magnitude arcing can occur and this is what is happening at switch number four.

With all four switches closed, assuming identical feeders, the current in each feeder will be one-third of the total current required by the two banks of transformers. Now when switch number four is opened, feeders number one and two each carry one-half the current required by the delta-wye bank while feeder number three carries all of the current required by the delta-delta bank. If the kva loadings on the two banks are quite dissimilar, which I think they are, the current in any one of the three feeders will undergo a radical change during the transition period from one stable condition to the other. The inductance in the circuit tends to prevent this rapid change and the arcing at switch number four is the result. The same analysis can be applied in a reverse manner, i.e. starting with switch number four open.

Since switch four is probably used to isolate one bank of transformers or the other, I think that the problem can be solved by inserting an oil circuit breaker in the high side of each bank and discontinuing the use of switch four.

Chicago, Ill. LEONARD CHMEL

Comments by Erisman

IN QUESTION 503, as J.A.K. states it, it is easy to see that switches 1, 2, and 3 are in parallel and therefore each blade of any one of them might be opened or closed without any trouble. J.A.K. does not mention it, but no doubt he first opens the OCB on circuits 1-2-3 before he opens or closes the disconnects. This would be safer procedure, for several reasons, some of which are mentioned later in trying to diagnose the trouble encountered with switch No. 4.

The current carrying capacity of the OCB's, cables, and knife switches of the 3 circuits are not given. To open either one or two circuits, the remaining circuit or circuits would have to have sufficient capacity to carry the load being pulled at that time, or trouble would be encountered.

If any one blade of the knife switches in circuits 1, 2, or 3 were opened and the system was loaded to such a point at that instant that all three circuits were necessary in order to have sufficient capacity, then serious arcing and system disturbance might result.

This would be true, because the resistance or impedance of the rest of the circuit would be too high and the current would attempt to keep flowing through the circuit being opened. Put another way, there would be a voltage difference across the switch due to the resistance of the other circuits causing low voltage to be on the load side.

This would not be the trouble experienced with switch 4 however, because none of the disconnect blades could be opened without causing the trouble mentioned.

Since trouble is only caused when the 3rd blade of switch 4 is opened and assuming that it is the same blade each time, say for example on phase C, then I believe the trouble might be caused by a high resistance connection on phase C, at any one of the following points. Such a high resistance could result in voltage difference across the blade contacts, causing trouble mentioned above.

1 — OCB contact — burned, pitted, poor alignments, tension, and the like
2 — OCB terminal — loose, small contact area, loose lug
3 — Disconnects — poor blade contact, loose connection, bad lug
4 — Bus bar — loose connection, oxidized, cracked due to too sharp a bend
5 — Cable — loose lug, broken strands, and the like.

If the three circuits shown have ammeters in each phase the above conditions might be detected.

Other signs to look for:

1 — OCB running hot
2 — Disconnect running hot, usually indicated by bluish appearance of the copper, soldered lugs might show melted solder
3 — Bluish appearance of copper at the bus bar joint.

J.A.K. does not state as to whether the disconnect blades have protective horn gaps.

The 3rd blade of switch No. 4 might have improper setting of or a defective horn gap, resulting in a transient voltage tending to fire across the blade as contact is broken. The arc might continue and cause disturbances mentioned.

Imperial, Mo. JESSE L. ERISMAN

LETTERS TO THE EDITORS

Astounding Response?

THE OVERWHELMING response to Question No. 497 — What Can He Do About This Hotwell Pump? — in favor of the float-controlled recirculating line is astounding. It is none other than the British "Weir" system of condensate flow control. Only my letter, so far as I know, suggested the accepted standard of this country which is control by cavitation. Times do change!

I should like to point out some reasons why control by cavitation has been generally favored in this country.

(1) It is simpler and requires no expensive float control valve which may become a maintenance problem.

(2) The power requirements are less since the pump does not operate at full capacity continuously.

(3) It does not reduce the surge capacity of the hotwell.

Ithaca, N. Y. E. S. MONROE

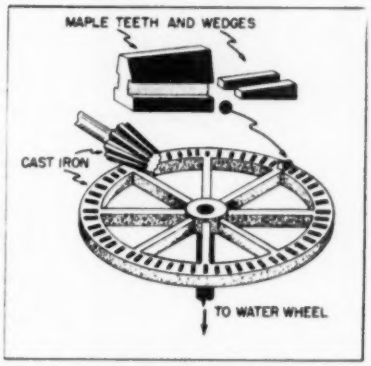
Wood Bearings

IN THE SEPTEMBER 1952 issue of POWER ENGINEERING, the article by R. F. Clothier, "How to Make and Use Lignum Vitae Bearings" was most interesting. It recalled to mind some equipment fitted with such bearings, which I both operated and saw in operation in the so-called good old days.

At home we had a wood-turning lathe which was built all of wood except the shaft and tail screw. The bearings were wood, wedge adjusted and, though made about 1800 there was no evidence of take-up. The lathe was used for turning net floats and later for furniture and tool handles and the like.

Where line shaft machine tool drives were used (universal before individual motor drives came in) each machine had a countershaft overhead, on which was a loose pulley driven by a belt from the line shaft. A shifter lever moved the belt to a tight pulley to drive the machine. The loose pulley might run 90 per cent of the time and, if it seized on the shaft the machine would start up and might cause an accident. To prevent this the loose pulley bearing was made of maple stewed in paraffin. Any heating extruded paraffin enough to lubricate.

In his article, Clothier mentioned lignum vitae bearings on water-wheel generators. This type of thrust bearing was standard equipment at the bottom of vertical water-wheel shafts 50 years ago. There were more than a hundred such wheels in and around Watertown, N. Y. They stood up where metal wore away with sand and no lubrication. Blocks of the wood were imported and bearings were made by pattern makers or millwrights as needed.



How the wood gear teeth were shaped and used

Another interesting use of wood in these same water-wheel generators was for wood gear teeth in large bevel gears at the top of the water-wheel shaft. These were wedged in rectangular holes in the wheel rim. They were made up for stock in the pattern shop.

It is rather amusing to an old timer in the game to see these old materials and methods come back into use when metal shortages make a demand for another way of doing the job. These old methods were tried and true as indicated by the above experiences.

Clayton, N. Y. ROB'T H. ROGERS

Editor's Note: — In New England textile mills, many years ago, the editor also saw vertical-shaft water wheels equipped with lignum vitae step bearings, as they were called. These bearings, lubricated only with water, gave long trouble-free service just like those mentioned by Mr. Rogers.

Electricity Direct from Heat

DURING 1949 and 1950, POWER ENGINEERING (then *Power Generation*) published an extremely interesting series of three articles by C. D. Bassett on generating electric power directly from heat by means of thermocouples. Carbon and silicon carbide were proposed as recently developed thermocouple materials, which produce about six times greater voltages than the well-known metal couples.

The merits advanced for such a power-producing set-up were both the absence of moving mechanisms and also the performance under a cycle that had a theoretical efficiency equal to the Carnot cycle.

Since the energy input to the thermocouples need not originate from fossil fuels, we were intrigued by the role that such a device could play in conjunction with either an atomic pile or with solar energy.

Thus, one of the writers, Mr. Thater, undertook a thesis topic in this field as part of his graduate studies at the Polytechnic Institute of Brooklyn.

Generally, it is known there are various imperfections or parasitic losses occurring when the thermocouple cycle is actually employed. What we wanted were some measurements to determine the seriousness of these losses. Based on actual data, an analysis should reveal whether this cycle is a power-producing panacea or just another pancake.

The test equipment, weighing 35 lb in its final form, consisted simply of a combustion chamber and a flue section. Thirteen silicon carbide-graphite thermocouples were inserted in the flue section with the hot junctions projecting into the interior and the cold junctions remaining on the outside of the flue. A gas burner served as a source of heat input to the furnace.

The silicon carbide, or carborundum, leg of the thermocouples consisted of a 6-in. length of $\frac{3}{8}$-in. rod. The particular carborundum used was called Globar by the manufacturer. This carborundum rod was arranged concentrically within a slightly shorter length of $\frac{3}{4}$-in. graphite pipe. Carbonaceous cement and wedges of graphite were used to fill the bottom inch of void between the rod and pipe, thus forming a solid joint at one end, the hot junction. At the other end of the thermocouple, the cold junction, a graphite strip, fastened with carbonaceous cement, connected the free terminal of the silicon carbide rod to the free graphite terminal of an adjacent thermocouple. In this fashion, the thirteen thermocouples were connected in series.

In operation, an average temperature of 1400 F was maintained at the hot junction, and 440 F at the cold junction. An open-circuit voltage of 1.25 v was obtained by the series connection of the thirteen thermocouples.

The useful electric output of the whole thermocouple pile was 0.002 watts.

Since we were anxious to attain a good voltage with a minimum number of thermocouples, we had a high flue gas temperature leaving the device. If we base the efficiency of the cycle upon the ratio of power output to fuel energy supplied, then we are saddling the thermocouple cycle with the burden of high exit gas temperatures imposed by our own design.

Thus, in order to be more considerate of the thermocouple cycle, we have taken the heat supplied to be that heat actually accepted by the

(*Continued on page 128*)

Fig. 1. Armature winding damaged by loose retaining ring and sheared holding pin

INSPECTING

Turbine-Driven Generators

Material shortages, serious damage, service interruption —all make inspection of turbine-driven generators important today. Here is what to look for when inspecting—

By J. B. SWERING
Chief Engineer, Electrical Div.
Hartford Steam Boiler Inspection and Insurance Co.

TODAY, with some materials in short supply, any machine damaged in an accident may be kept out of service for an abnormally long period awaiting repair parts. As a result, plant production can be seriously affected.

This is particularly true with turbine-driven generators, as this writer showed in *The Locomotive*. An accident to a generator usually means copper will be required for repair — and copper is one of the hard-to-get materials. In addition, such an accident is likely to cut off a large part, if not all, of plant power supply, with a corresponding effect upon plant operations.

Prevention of accidents by inspection of turbine generators, therefore, is more important than ever today, and it seems timely to review some important features of such inspections.

According to our statistics, 85 per cent of armature winding failures take place in the end turns; as against 15 per cent in the slots. Therefore, end turns should get special attention in inspection and maintenance programs to prevent results similar to that shown in Fig. 1.

Armature (Stator) Inspection

Insulation of the end turns is subject to cracking near the end of the slots, especially on some older generators. When asphalt-base insulation becomes approximately 20 years old, if not earlier, these cracks usually begin to appear. They indicate winding has about reached the end of its life, and plans for rewinding should be made. Cracking of this kind has been found even on base-load machines with a history of continuous, normal operation.

Defects beneath insulation surface are hard to detect. Some forms of disintegration are difficult to recognize until they have progressed so far that failure is imminent or overdue. Although insulation may appear bright and firm on the surface, deterioration may exist beneath; but with experience, this can be determined to some extent by careful visual inspection.

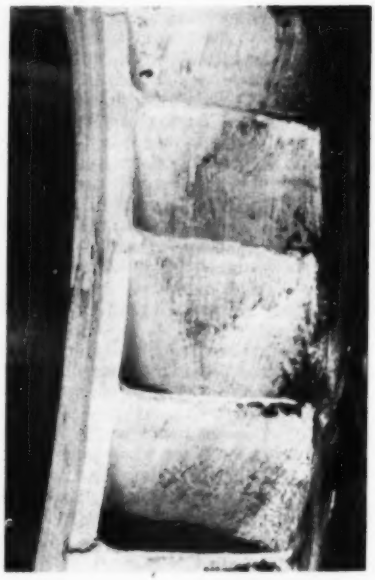
An insulation resistance test should also be made. It may be a spot test of 1 min, or it may be an absorption test of several minutes; or both. AIEE Report No. 43 (Recommended Practice for Testing Insulation Resistance of Rotating Machinery) should be followed in making such tests.

A-c/d-c over-potential testing is being used on large units to some extent. This is not recommended unless applied with caution by engineers familiar with latest procedures. It is too early to evaluate results of such tests which are still in the development stage.

On a high-voltage machine, signs of corona effect should be sought. It usually shows up as a gray-white deposit on the end turns. When this condition is found, manufacturer of the generator should be consulted for the proper method of correcting the trouble.

All mechanical parts of the armature should be carefully checked. Close inspection is needed to disclose broken or deteriorated lacings, loose blocking, and defects in other fastening or binders. End turns should be checked for distortion.

Fig. 2. Cracks in the fan of a generator were disclosed by a whitewash test during inspection



Laminations should be examined for tightness and signs of heating at end plates or fingers at both ends of the armature. This is especially important on a unit operated above rated power factor.

It is necessary, of course, to check for dirt or foreign accumulations, even with a closed, air-cooled machine. Accelerated insulation breakdown or deterioration from overheating can be materially lessened if windings are kept clean.

On a machine with a closed ventilating system, water leakage is a hazard. Leakage can sometimes be detected in early stages by discoloration at tubes or tube ends in the cooler. Prompt correction of a small leak may stave off a serious accident.

Terminal bushings should be examined for cracks and cleanliness, and condition of all leads and supports should be noted. Bearing pedestal insulation is another point to be checked. Loss of insulating effect in any part of pedestal insulation may result in bearing and shaft currents.

Rotor Winding Inspection

Examination of a non-salient pole rotor winding is restricted by the enclosed design. Nevertheless, an effective inspection can be made.

Ventilating holes in the rotor body can be used to check slot insulation. If it is found that insulation has flared out into the ventilating holes, then the rotor should be viewed with suspicion.

Insulation resistance tests should be made, and will often disclose faults that can be corrected before complete breakdown occurs. A maximum of 500 v should be used (premature failures have occurred at higher voltages).

It is best to make a series of insulation resistance tests at different speeds from zero rpm to normal operating speed. If readings vary, it is almost certain to be a sign of impending trouble and indicates need for further examination of the rotor, even to the extent of pulling retaining rings.

An acceptable reading while the rotor is at rest does not mean a similar reading will be found while rotating. Rotors have been found to test at high readings while at rest, but showed a grounding condition when tested at operating speed.

For a time our company kept a check on insulation resistance readings taken at different speeds on turbine generator rotors of non-salient pole design. In every case where readings were found to vary, rotors were dismantled and faults of one kind or another were found. In many instances, complete rewinding was required. As a result, variable speed insulation resistance tests have been established as a regular inspection procedure.

When a unit is dismantled for complete inspection the field should be removed from the armature. Special attention should be paid to rotor retaining rings and centering rings. A loose ring usually shows rust-like discoloration at the shrink fit.

Edges of retaining rings next to the rotor body need to be closely examined for cracks, especially if any discoloration of metal is noted. In some cases the condition progresses to the point where small pieces break out at the edge of the ring. Rings found in this condition should be replaced.

In addition to examining retaining rings at regularly scheduled dismantling inspections, it is advisable to open the generator for a check on the condition of retaining rings and other rotor parts if the unit has been subjected to heavy faults and possible single-phase operation (Fig. 3) or dangerously unbalanced poly-phase loading.

All bolts and similar fastenings on the rotor should, of course, be examined for loosening at each inspection. Rotor fans should also be checked for loosening and cracks; see Fig. 2. Broken fans can damage a machine severely, necessitating a complete rewind.

A check on the condition of collector rings and brushes is included as a part of complete dismantled inspection, but these parts should also be given attention as a part of the regular operating maintenance program. Ring surfaces should be kept smooth and polished, and accumulations of carbon dust on the brush rigging and collector ring insulation should be removed each time the unit is shut down.

General Inspection

Protective devices should get complete examination and testing. This includes a check on the condition of lightning and fire protection equipment. Differential relays, ground relays and reverse power relays should also be tested.

Synchroscope should be checked. It is a good idea to have lamps installed with the synchroscope as an added safety measure. Accidents have happened as a result of loose synchroscope pointers that turned on their shafts and caused false readings. Lamps will disclose such a condition.

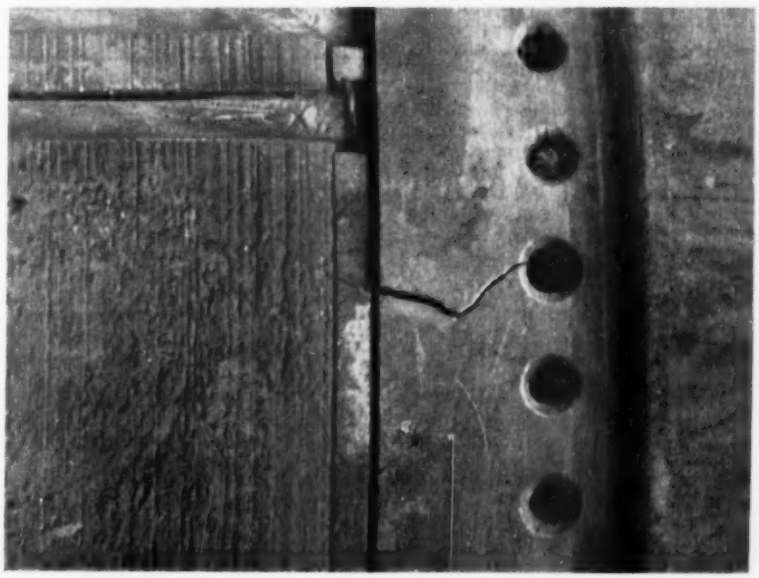
It is important to take load balance readings in all phases and record them on the log sheet. Phases should be balanced as closely as possible. Maximum nameplate rating for armature and field should not be exceeded. There have been many cases of damage to rotors of industrial plant generators as a result of unbalanced load on plant distribution systems.

Accidents to Idle Units

A word of caution should be added about accidents caused while a unit is standing idle or being repaired. Accidents of this kind include many cases where fields have been burned out because someone forgot to remove excitation when a machine was shut down. In other cases rotors and stators have been damaged because a tool or other object was left inside when a generator was closed up.

Some serious accidents have resulted when disconnect switches were left closed while a machine was idle. If disconnects are not opened there is always the chance someone may close the breakers thoughtlessly and throw power on the machine. Results are disastrous. There have been quite a number of serious accidents of this kind recently, some of them involving large units, and it is strongly recommended that instructions for operators include a rigid requirement for opening disconnects whenever a generator is idle.

Fig. 3. Single-phase operation caused a dangerous crack in the retaining ring of this generator rotor



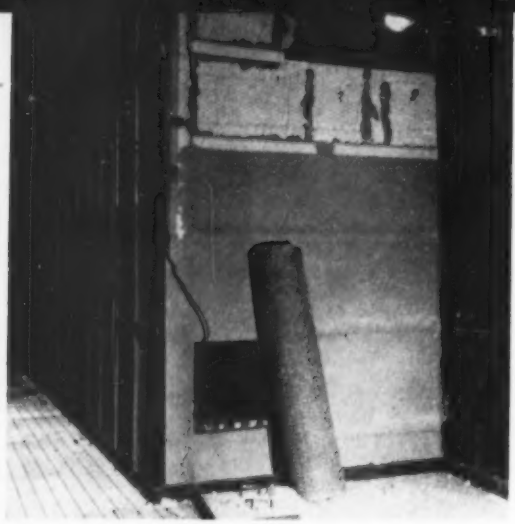


Fig. 1. Hexagonal wire mesh has been applied over diatomaceous silica and 85 per cent magnesia insulation on this air preheater. A first coat of asbestos cement has been started

Bigger load, higher fuel costs and use of more superheated steam made piping and equipment heat loss very important. Result—new insulation specifications

By J. H. HANNA, Jr.
Plant Engineer
Benning Generating Station
Potomac Electric Power Co.

Benning Expansion Calls For Second Look at Insulation

WASHINGTON, the nation's capital, obtains its electricity from the Potomac Electric Power Company. So do two-thirds of Montgomery County and Prince George's County (Maryland), and a small portion of Virginia. With a steady influx of new customers, demand placed upon the company's generation and distribution systems during the past 4 years has increased by leaps and bounds. In fact, for the year ending December 31, 1951, total kilowatt hours sold were in excess of 2½ billions, representing an increase over 1947 of more than 37 per cent.

So insistent has been this steady climb of electric power consumption, that the company has had to enlarge its facilities continually in order to stay ahead of peak load demands. Two most recent expansion projects, both being handled by Stone & Webster Engineering Corp., involve the Benning Plant and the Potomac River Plant, which, when completed, are scheduled to add a total of 115,000 kw to the system's rated name-plate capacity. Work at Potomac River is under way, to be finished in the spring of 1954. The 25,000-kw topping unit at Benning, on the other hand, is near completion.

Plant Equipment

Benning Station, started in 1906, was added to continuously until 1931. In 1947, when No. 25 boiler at 675 psig and 900 F was added and some other equipment retired, the old plant consisted of 12 boilers operating at 200 psig and 550 F, and 12 boilers of 400 psig and 700 F steam conditions.

Only three years later the company, faced with the realization that demand was again closing in on plant capacity, decided to provide still greater facilities, and is now installing a new Combustion Engineering Type CCRR boiler and a 25,000-kw General Electric topping turbine. Boiler has a rated continuous capacity of 675,000 lb of superheated steam (1525 psig, 1000 F) per hr. Pulverized coal is tangentially fired. Forced draft fans supply air preheated to 560 F in a tubular air preheater, Fig. 1. Exhaust gases leave the stack at approximately 310 F, after passing through a combination mechanical fly ash collector and electrostatic precipitator. Feedwater is heated to some 440 F in a closed feedwater heater. Makeup is treated before being admitted into the water loop via the 400-psig boilers.

With the addition of the new topping turbine, the plant's system was partially revamped. Superheated steam from the new No. 26 boiler is admitted into the topping turbine. Its exhaust, at 400 psig and 700 F, is now passed into headers feeding three 30,000-kw turbine generators previously in the plant, and augmenting output of the twelve 400-psig boilers. In fact, the quantity of exhaust obtained is sufficient to permit the output of 6 to 8 of these 400-psig boilers to supply the 200-psig header through a pressure reducing and desuperheating station.

Table I. Schedule for insulation thicknesses, in inches, used for piping Potomac's Benning Station

Temp. Range F	½	¾	1	1½	2	2½	3	3½	4	5	6	8	10	12 and Up
900–1015 D. Silica	2½	2½	2½	2½	2	2	—	—	—	—	3	3	3½	3½
85% mag.	—	—	—	—	1½	1½	—	—	—	—	1½	1½	1½	1½
750–900 D. Silica	2	2	2	2	1½	1½	1½	1½	1½	1½	1½	1½	2	2
85% mag.	—	—	—	—	1½	1½	2	2	2	2	2	2	2	2
550–750 D. Silica	2	2	2	2	1	1	1	1¼	1¼	1¼	1½	1½	1½	1½
85% mag.	—	—	—	—	1½	1½	1½	1½	1½	1½	2	2	2	2
350–550 85% mag.	2	2	2	2	2	2	2	2	2¼	2⅜	2⅜	2½	2½	3
250–350 85% mag.	⅞	⅞	⅞	⅞	1½	1½	1½	1½	1½	1½	2	2	2	2
100–250 85% mag.	⅞	⅞	⅞	⅞	1½	1½	1½	1½	1⅛	1⅛	1⅛	1¼	1¼	1½

Insulation Calculations

With fuel costs increasing, heat losses through the plant's equipment and piping assumed added significance, and thermal insulation was carefully considered. Re-examination of insulation specifications was indicated, too, by the large volume of superheated steam with its greater relative value.

By taking into account such fac-

WILL THIS

ORGANIC AGENT ELIMINATE BOILER SCALE AND SLUDGE?

It might.

In water conditioning, the supplementary use of organic agents may well assure the difference between long, uninterrupted operation and frequent boiler outages due to scale and sludge formations.

But a word of warning! Not all organics are the same or equally effective.

Take, for example, the case of a large mid-western steel plant which had to acid-clean its 450 psi boilers at 8-12 month intervals.

Due to sharp variations in the raw polluted river water, the hardness and silica content of the lime soda effluent could not be maintained consistently as low as desired. Despite the use of phosphate-tannin treatment, boilers opened up in poor condition.

Betz Engineers studied the problem and recommended changing the type of organic. Results? Since this change, the boilers have not been acid-cleaned or turbined in three years.

What's more, the latest inspection report after 11 months' operation, showed that the only deposit found in the boilers was a handful of sludge.

If *your* plant is plagued by scale and sludge deposits, why not do something about it *now*, by calling in a Betz Engineer. He'll show you factual evidence how Betz *Specialized* Water Conditioning Service can help you solve *your* water problem. W. H. & L. D. BETZ, Gillingham & Worth Streets, Philadelphia 24, Pa. In Canada: BETZ Laboratories Limited, Montreal I.

Write today for a copy of Betz Technical Paper No. 98, "Boiler Scale —Its Formation and Prevention."

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tors as annual hours of operation, operating temperature, coefficient of heat transfer, and cost of fuel, desirability of proportionately thicker insulation than had been used on the older 400-psig and 200-psig units was indicated.

While direct comparisons are not possible because of different operating factors in the new and old sections of the plant, insulation thickness tables shown indicate the trend toward heat loss reduction.

Insulation Procedures

In the new wing, 85 per cent magnesia was used to insulate steam generating equipment and auxiliaries, all hot pipe lines — steam, exhaust, blowoff and drain, feedwater, fuel oil — as well as valves, flanges and fittings operating above 100 F. In some cases, as for example the boiler safety blowoff line or the turbine-driven oil pump exhaust line, insulation was provided for personnel safety rather than for heat conservation. Insulation contract was handled by the Standard Insulation Company of Maryland.

Prior to applying insulation, all piping was pressure tested. The 85 per cent magnesia or diatomaceous silica-combination insulation of thicknesses shown in Table I were then wired into place with 16-gage annealed iron wire. Higher fuel costs are reflected by comparing this schedule with 1918 specifications, calling for 1-in. 85 per cent magnesia insulation on 16-in. headers at 200 psig and 500 F. Where 2 in. or more of insulation were required, insulation was applied in two layers, with longitudinal and transverse joints staggered. All joints were firmly butted and pointed up with insulating cement. Piping was finished with a wrap of 40-lb rosin-sized paper and an 8-oz sewed canvas jacket, as shown in Fig. 2. Where pipes ran closely enough to permit it, entire groups were insulated as one unit. Asbestos cloth was used as a jacket instead of 8-oz canvas where bare metal reached a temperature above 600 F and protruded through insulation, as in the case of valve yokes. Asbestos cloth was carried back far enough to prevent charring of adjacent canvas.

Bodies of fittings, as well as bodies and bonnets of valves, were also insulated with 85 per cent magnesia. Those in 4-in. or larger lines were insulated with magnesia block, ½ in. thinner than adjacent pipe insulation, and finished with asbestos and hard finish cement, each layer ¼ in. thick. On smaller sizes only hard finish cement was used, molded to the same thickness as the insulation on adjacent piping. An 8-oz canvas jacket was sewed on in all cases.

In order to avoid excessive temperature differences between piping, flanges and flange bolts during the 24-hr pressure test under operating conditions, temporary insulation was applied to flanges above 350 F. After pressure tightness had been achieved, a permanent flange insulation was substituted, consisting of either block or sectional 85 per cent magnesia (depending on flange diameter) and secured with 16-gage annealed iron wire. A layer of asbestos and hard finish cement, each ¼ in., was applied over the block magnesia insulation on larger flanges. Total thickness of all flange insulation was the same as the thickness of insulation on adjacent piping. Sewed 8-oz canvas jackets completed the application.

In insulating the plant's equipment (including ducts and flues) the following procedure was employed: Most of the equipment installed in the plant was furnished with insulation clips, usually on 12- or 18-in. centers, to which short lengths of annealed iron wire were fastened by the contractor. In addition, on large and regular surfaces, continuous angle-iron supports were provided. Blocks of 85 per cent magnesia or diatomaceous silica-combination insulation were applied between rows of insulation clips or angle irons, firmly butted, and tightly laced into place with annealed iron wire. Thicknesses are shown in Table II. Hexagonal 2-in. wire mesh, as shown in Fig. 1, was then drawn tight over the laced insulation blocks and firmly secured. A ¼ in. layer each of asbestos and hard finish cement, troweled smooth, comprised the finish.

All access doors, removable panels, manhole covers and other parts which must be opened or removed were also insulated. Insulation on removable parts, as well as on portions adjacent to them, was permanently secured in place with wire mesh, beveled to minimize damage, and edges and corners protected by light structural angles or metal strips. Removable insulation was provided on all pressure vessels and piping where code inspection data appear.

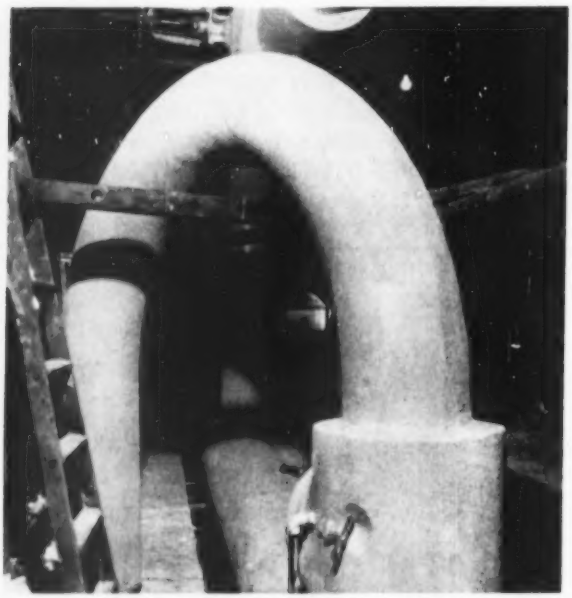
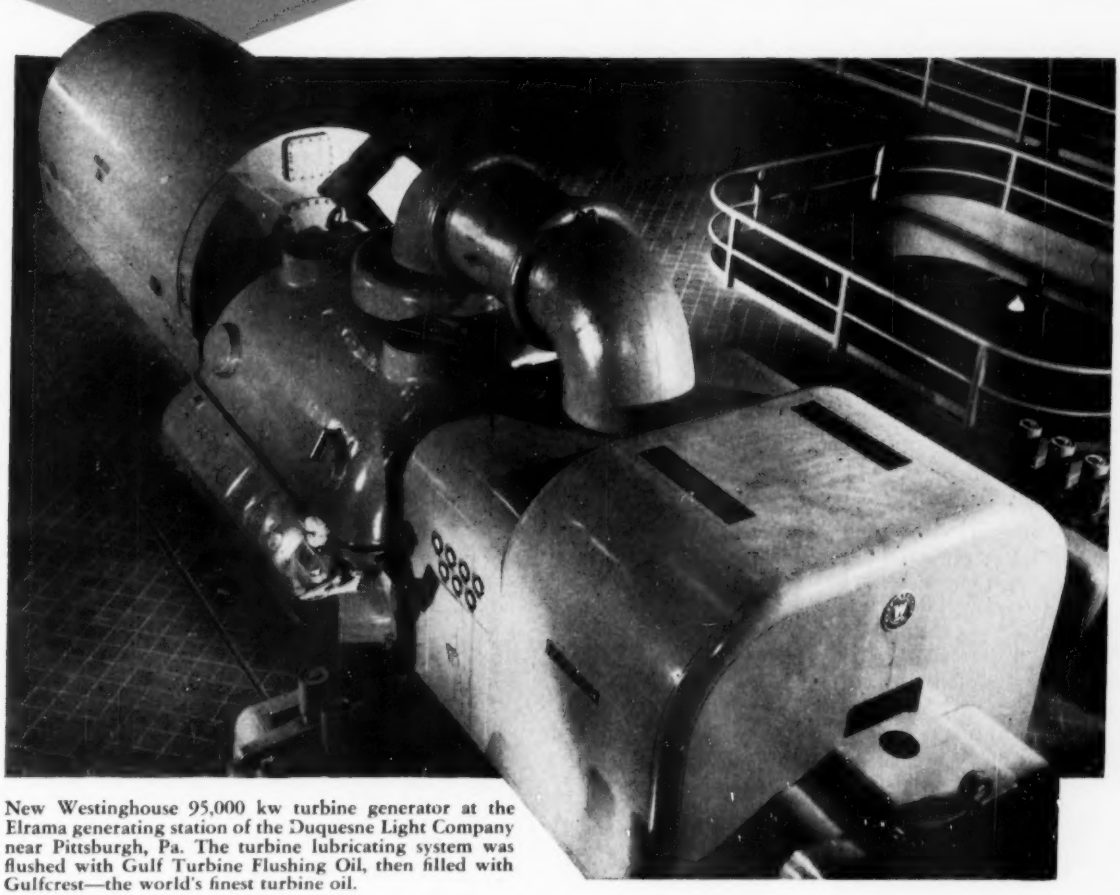


Fig. 2. In expansion, 200-psig header and steam main connections were changed. Boiler and auxiliary leads (U-bend) were heavily reinsulated

Table II. Schedule of insulation thicknesses, in inches, for plant equipment

Unit	Operating Temp. F	Diatomaceous Silica	85% Magnesia
Reboiler flash tank	215	—	1½
Auxiliary flash tank	215	—	1½
Electrostatic precipitator	330	—	2
Mechanical fly ash collector	320	—	2
Thoroughfare deaerating heater	230	—	2
1,000,000 lb hr deaerator			
(a) deaerator section (b) storage section (c) two vent condensers	227	—	2
Deaerator overflow flash tank	215	—	1½
Primary fuel oil heaters	280	—	1½
Secondary fuel oil heaters	230	—	1½
Tubular air preheater	550	1½	1½
Preheated air ducts	560	1½	1½
Induced draft fans	310	—	2
Induced draft ducts	310	—	2
Boiler drum heads	615	1½	2

GULFCREST OIL selected for another big turbine-95000 kw



New Westinghouse 95,000 kw turbine generator at the Elrama generating station of the Duquesne Light Company near Pittsburgh, Pa. The turbine lubricating system was flushed with Gulf Turbine Flushing Oil, then filled with Gulfcrest—the world's finest turbine oil.

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In industry after industry, you'll find leading companies are setting the pace for efficient, reliable steam production with C-E Vertical-Unit Boilers.

The Chemical Industry is a typical example. For VU Boilers have been purchased by most of the major manufacturers in this industry, including such nationally-known leaders as those shown in the list below.

Furthermore, chemical manufacturers, both large and small, have *proved* their satisfaction with Vertical-Unit Boilers by buying them again and again. In 1951, for example, more than 60 per cent of the VU capacity ordered by chemical companies represented repeat order business. One leading manufacturer, in fact, has purchased twenty-seven units during the past twelve years – *eleven of them in 1951!*

You can profit from the experience of the Chemical Industry – as from any industry where steam for power or process is of major importance. If you use steam, investigate the lower steam costs you can get through the advanced design . . . sound construction . . . proved reliability of VU Boilers. They are available in capacities to fit your needs–from 10,000 to 350,000 pounds of steam per hour.

Typical List of Chemical Companies that have purchased VU Boilers for one or more plants

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Atlas Powder Co.
Carbide & Carbon Chemical Corp.
Colgate-Palmolive-Peet Co.
Diamond Alkali Co.
E. I. du Pont de Nemours & Co., Inc
B. F. Goodrich Chemical Co.
Hercules Powder Co.
Merck & Co., Inc.
National Distillers Chemical Co.
Pennsylvania Salt Mfg. Co.
Pittsburgh Coke & Chemical Co.
Charles Pfizer & Co.
Shell Chemical Co.
U. S. Industrial Chemicals Co.

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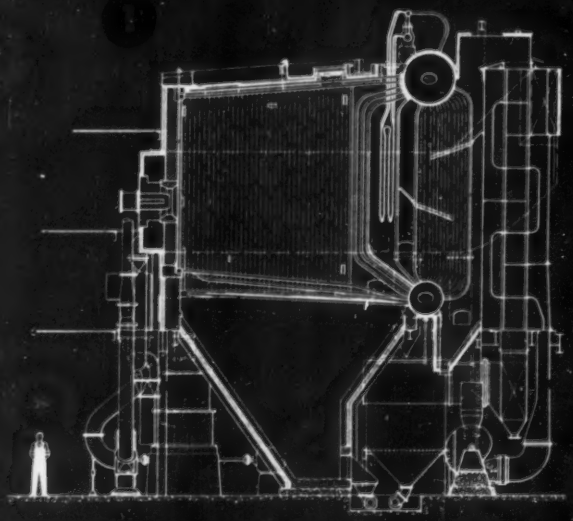
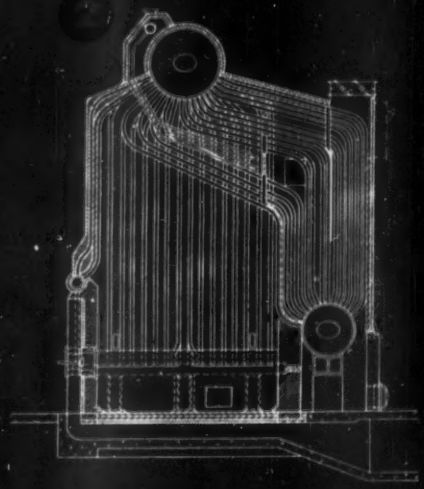
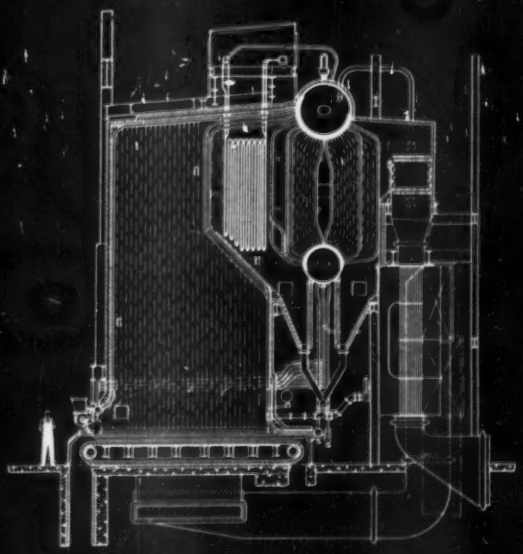




1 VU-50 BOILER installed in Midwestern plant. This boiler is fired with pulverized coal using C-E Raymond Bowl Mills. The capacity is 65,000 lb of steam per hr. Steam pressure is 400 psi — steam temperature is 600 F.

2 VU-10 BOILER fired with oil. Installed in an Eastern plant, the boiler's capacity is 15,000 lb of steam per hr at 250 psi and 480 F. VU-10 capacities range from 10,000 to 60,000 lb of steam per hr. They may also be fired by spreader, underfeed or chain grate stokers.

3 VU-40 BOILER installed in a large Southern plant. This unit is fired by coal, using C-E Spreader Stokers (continuous discharge type). Capacity of this boiler is 150,000 lb of steam per hr at a pressure of 900 psi and a temperature of 808 F.



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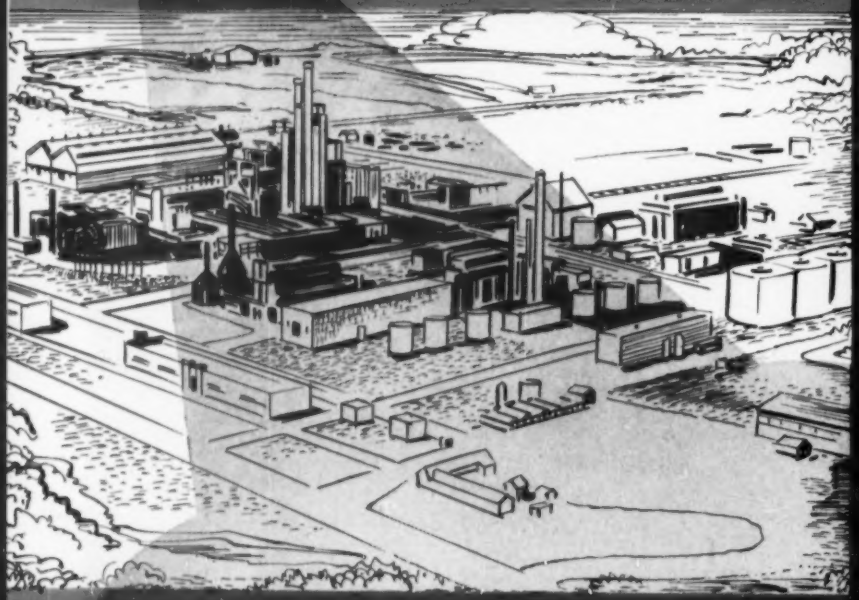
BIG effects from little traps! And, the effects are multiplied by the number of traps in the plant you design or operate until they grow to be a *major* influence upon operating efficiency and economy. Before you specify steam traps ask your nearby Armstrong Representative to call. He is qualified to give you practical assistance and answers that can save you a lot of time and trouble.



THINGS STEAM TRAPS AFFECT

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Forged steel series for [illegible] pressures to 1500 psig [illegible] for low and medium [illegible] where all-steel [illegible] are desirable.

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When steam is turned on, large amounts of condensate *and air* must be removed before equipment heats up.	Condensate *and air* removed as fast as they reach trap. Reliable data insures you get trap with adequate safety factor to meet conditions.	*40 Minute Faster Heat-up*—drying oven at pharmaceutical plant heats up 40 minutes sooner with Armstrong "Blast" traps.
Quick heat-up, maximum temperatures essential for maximum output.	Air which reduces temperature and heat transfer discharged automatically; condensate discharged at steam temperature; equipment kept *full* of hot, dry steam.	*30% Greater Output* — jacketed kettles produce 30% more at Canadian plant since changing to Armstrong traps.
When steam gets past traps, boiler capacity may be inadequate—this is bad even if you could afford the fuel waste.	When steam floats the bucket the trap closes. No steam ever reaches discharge orifice, even when there is no condensate load. Heat treated chrome steel valve parts, precision ground and lapped, resist wire drawing and wear, stay leak tight for a long, long time.	*Steam Savings Eliminate Need for New Boiler*—chemical plant shelves plans to buy larger boiler after installing Armstrong Traps.
Why burn fuel to generate steam that does no useful work . . . blows through traps, for example?		*33⅓% Reduction in Fuel Bill* — after trapping vats with Armstrongs at Missouri plant.
When traps are inoperative or down for repairs, unit being drained may be "off the line."	Nothing to clog, seize, stick or collapse! Large orifice. Self-scrubbing action cleans out ordinary dirt and scale. "Frictionless" leverage with wear points heavily reinforced for long life. Hardened chrome steel valve and seat. Wear and corrosion-resistant stainless trim.	*Maintenance Time Cut 30%* — Illinois user says, "Unequalled dependability, simplicity of design means repairs can be made quickly" (with minimum equipment downtime).
Traps that don't "wear well" take a lot of manhours for repair.		*50% Less Trap Maintenance* — only half as many manhours devoted to traps since installing Armstrongs throughout large Midwestern plant.

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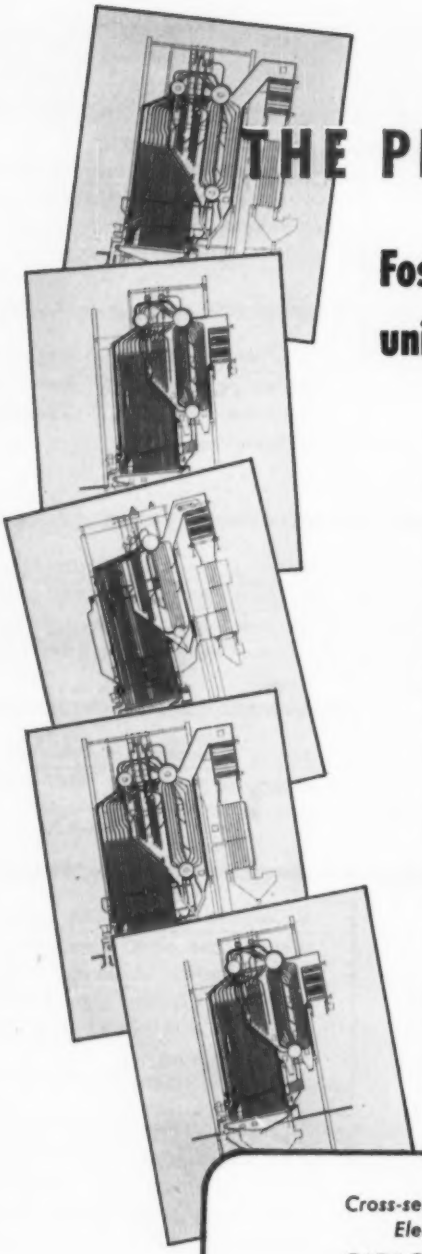
Fresh off the press — 44 pages of practical trapping data. Tells how to select traps for nearly every class of equipment; explains safety factors; gives prices, physical data, service pressure ratings of Armstrong traps; includes recommended installation, maintenance and trouble-shooting practice; contains many time-saving charts and tables — condensing rates, trap capacities, trap size recommendations and others. For your free copy, call your local Armstrong Representative or write to Armstrong.

STEAM TRAPS



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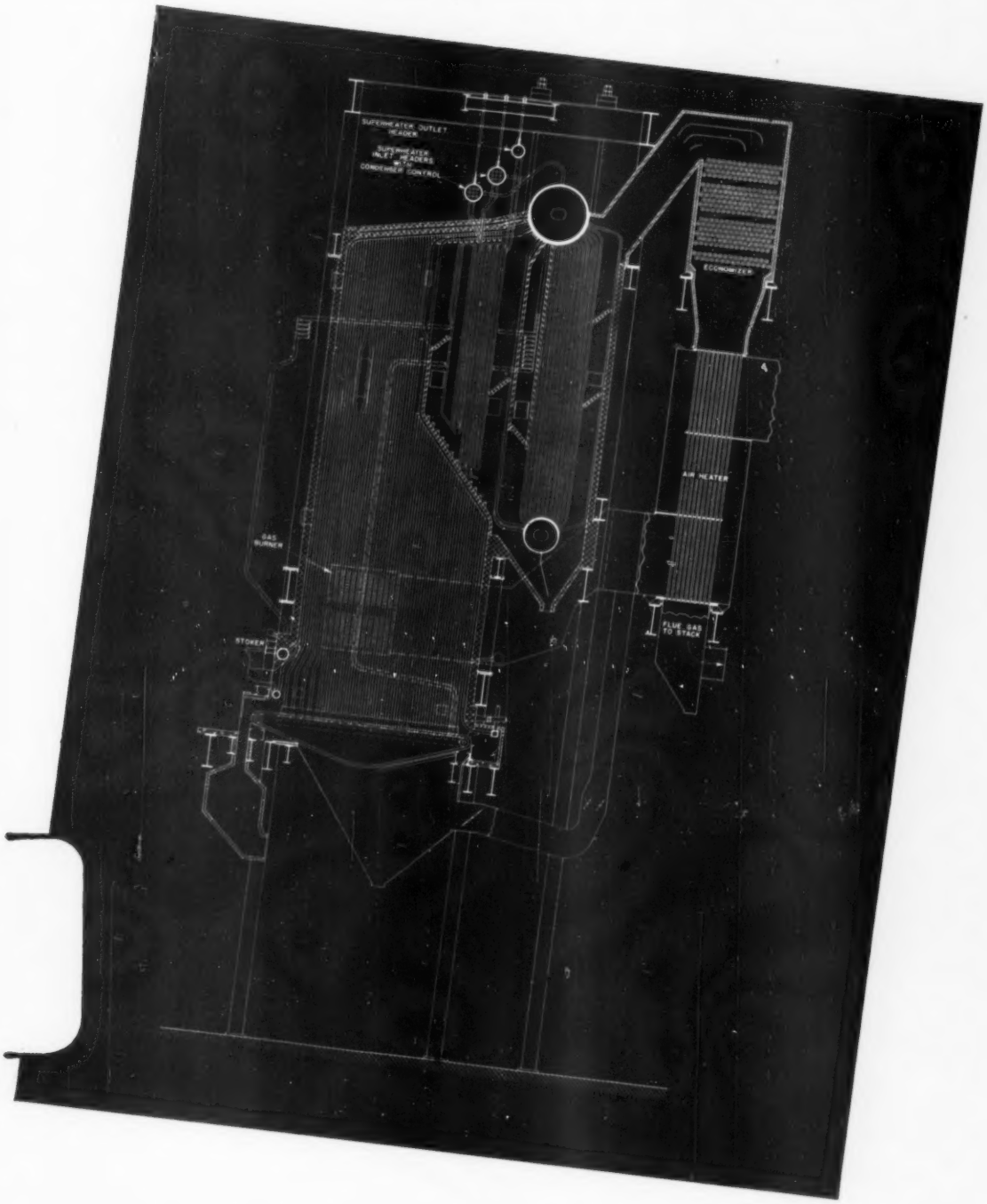

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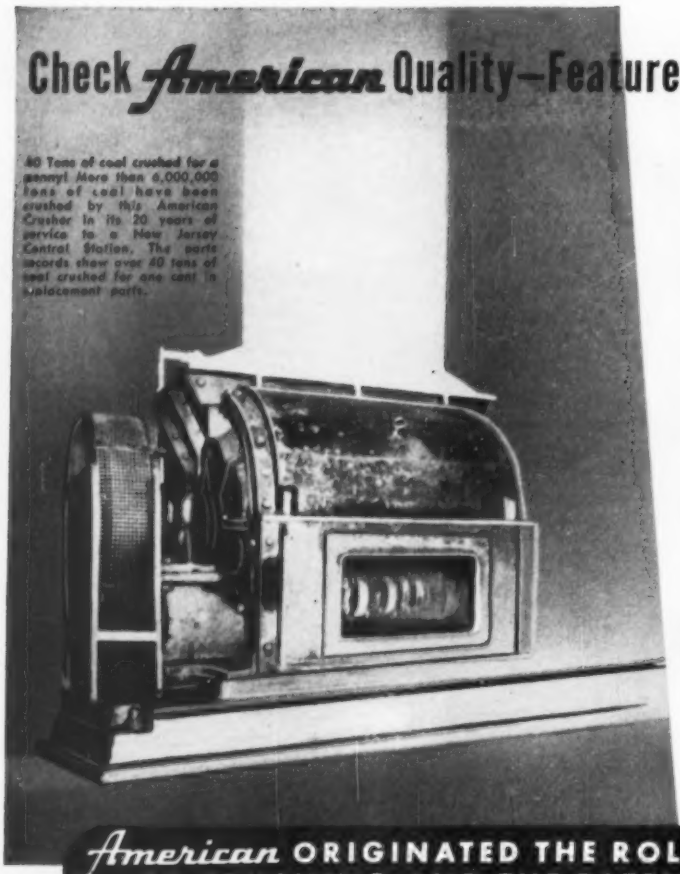
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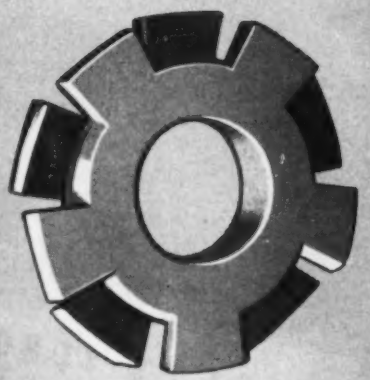
The American Rolling Ring Crushers operate efficiently at slow speeds resulting in major savings in power consumption and maintenance as well as producing a better product.



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with SUPER-SILVERTOP Steam Traps

Piping must be disconnected to service a conventional inverted bucket trap, but a Super-Silvertop can stay right in the line.

● Plants that trap steam-using equipment with engineered Super-Silvertop Steam Traps find there are four reasons why there is less time out with these cost-saving units.

1 **You can service a Super-Silvertop much easier than conventional traps, saving up to 30 minutes time. The body can be removed without disturbing a single fitting.**

2 **Super-Silvertops are easy to install, too. They fit snug, like an elbow or coupling, eliminating unnecessary piping and fittings usually required to hook up conventional inverted bucket traps.**

3 **Super-Silvertops have rugged, longer-lasting Anderloy valves and seats, eliminating continual replacement of parts.**

4 **Guided bucket minimizes bucket damage caused when bucket swings free.**

Thousands of leading plants are saving manhours by changing to Super-Silvertops. You can, too. Write for a copy of the 36-page catalog, "Solving Steam Trap Problems". It tells how.

SUPER-SILVERTOPS
...the Engineered Steam Traps

THE V. D. ANDERSON COMPANY
1977 West 96th Street • Cleveland 2, Ohio

Gentlemen:
Please send me a copy of "Solving Steam Trap Problems".

Name ..... *Title* .....
Address .....
City .....
State .....

In Canada: Bawden Industries Ltd., Toronto

For more data circle 543 on Post Card

How to make packings last longer

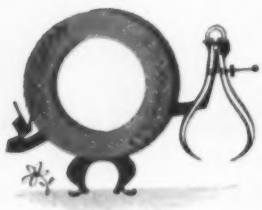
Tips by Johns-Manville Engineers to help you keep production rolling

Correct installation cures many packing troubles

Danger! Don't mix me with old packings

Old packings may look all right, but often they are so dry and highly compressed that they may cause scoring. Play it safe and remove *all* old packing before putting new packing in place. Be sure to remove accumulations from stuffing box walls, gland follower and shaft. New packing is cheaper than new rods, shafts and sleeves!

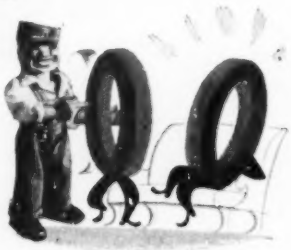
Make sure I'm the right size



Packing that's too small may turn with the shaft. Oversize packing may cause excessive pressure and subsequent scoring. To find the correct size, check the rod or shaft diameter and the inside diameter of the stuffing box—then choose a packing to fit. In this way, allowance is automatically made for wear of the rod.

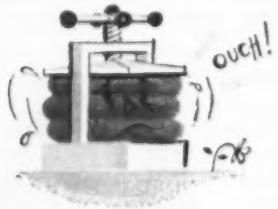
Seat me one ring at a time

Never load the stuffing box with packing rings and try to seat them all at once by tightening the gland follower. This invites trouble due to excessive gland pressure. Always install one ring at a time, making sure it's properly seated *before* the next ring is installed.



Don't squeeze me too tight!

Too much gland pressure is a common cause of packing failures. After the packing is installed, pull up the follower only sufficiently tight to insure seating of the last rings installed. Then back it off, leaving the nuts finger-tight. Don't worry about a little leakage. Actually, it's good assurance that the packing isn't too tight in the stuffing box. Besides, the liquid frequently has some lubricating qualities.



Why you can expect longer life from

NAVALON Style No. 190

Made from specially processed ramie—nature's strongest fiber—Navalon stands up in severe service where other cold-liquid packings fail. It gives outstanding performance in pumps, elevators, accumulators, presses, and on reciprocating rods and plungers operating against fresh or salt water, brine, cold oil and many other liquids.

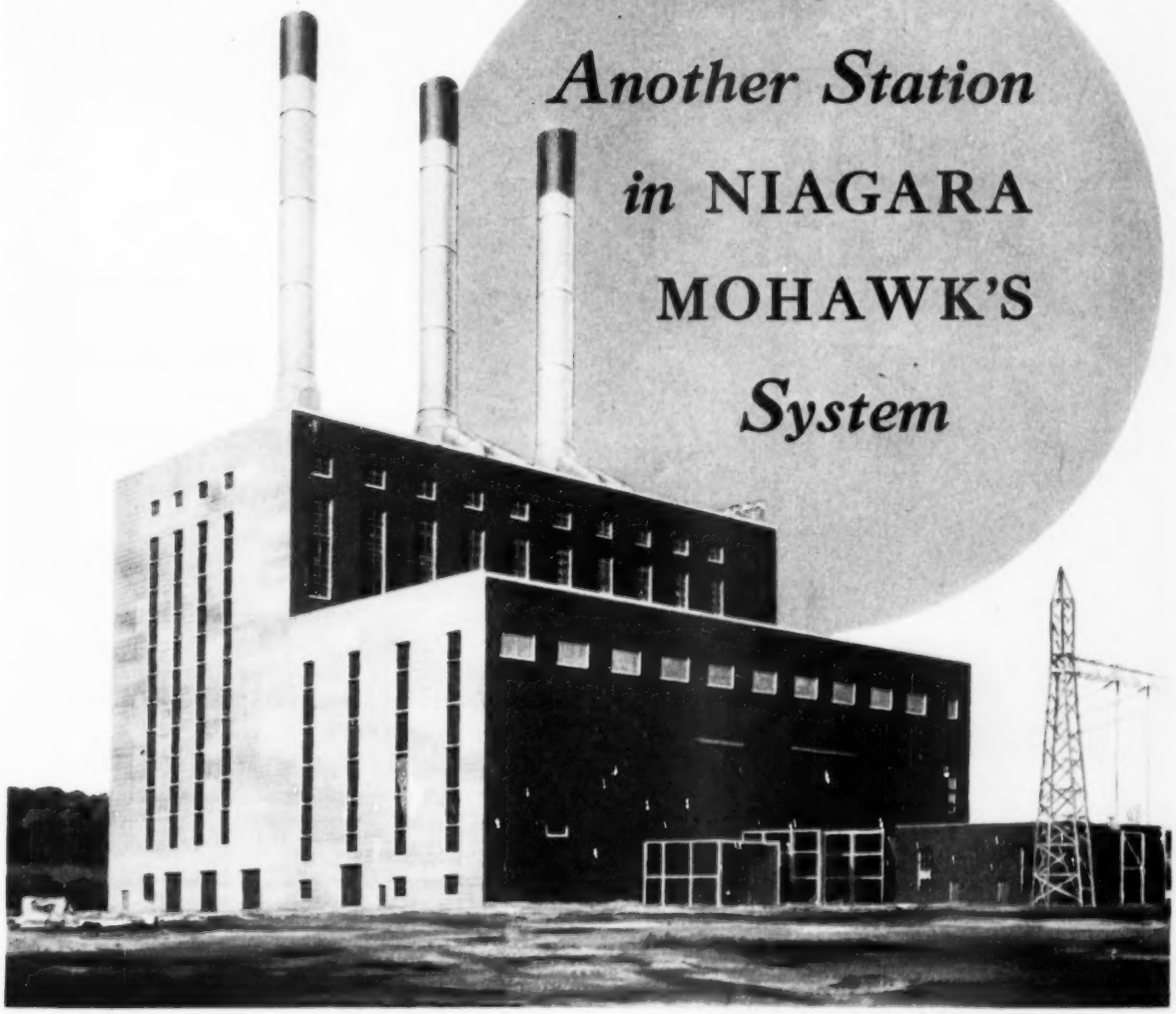
Your distributor will help, too! Your J-M Packing Distributor can help you take the guesswork out of packing problems. He carries complete stocks of Johns-Manville quality packings and can supply you promptly. For the address of the J-M Packing Distributor nearest you, write Johns-Manville, Box 60, New York 16, N. Y.

JOHNS-MANVILLE JM PRODUCTS

Johns-Manville PACKINGS & GASKETS

For more data circle 544 on Post Card

Another Station in NIAGARA MOHAWK'S *System*



ALBANY STEAM STATION
Two units of 100,000 kw each are already in operation, a third is under construction and foundation for a fourth unit is underway

Albany Steam Station, on the west bank of the Hudson River at Albany, New York, serves the eastern part of New York State primarily and is an integral part of the Niagara Mohawk power network.

Designed by the engineering department of Niagara Mohawk Power Corporation with construction supervision by Stone & Webster Engineering Corporation.

STONE & WEBSTER ENGINEERING CORPORATION

A SUBSIDIARY *of* STONE & WEBSTER, INC.

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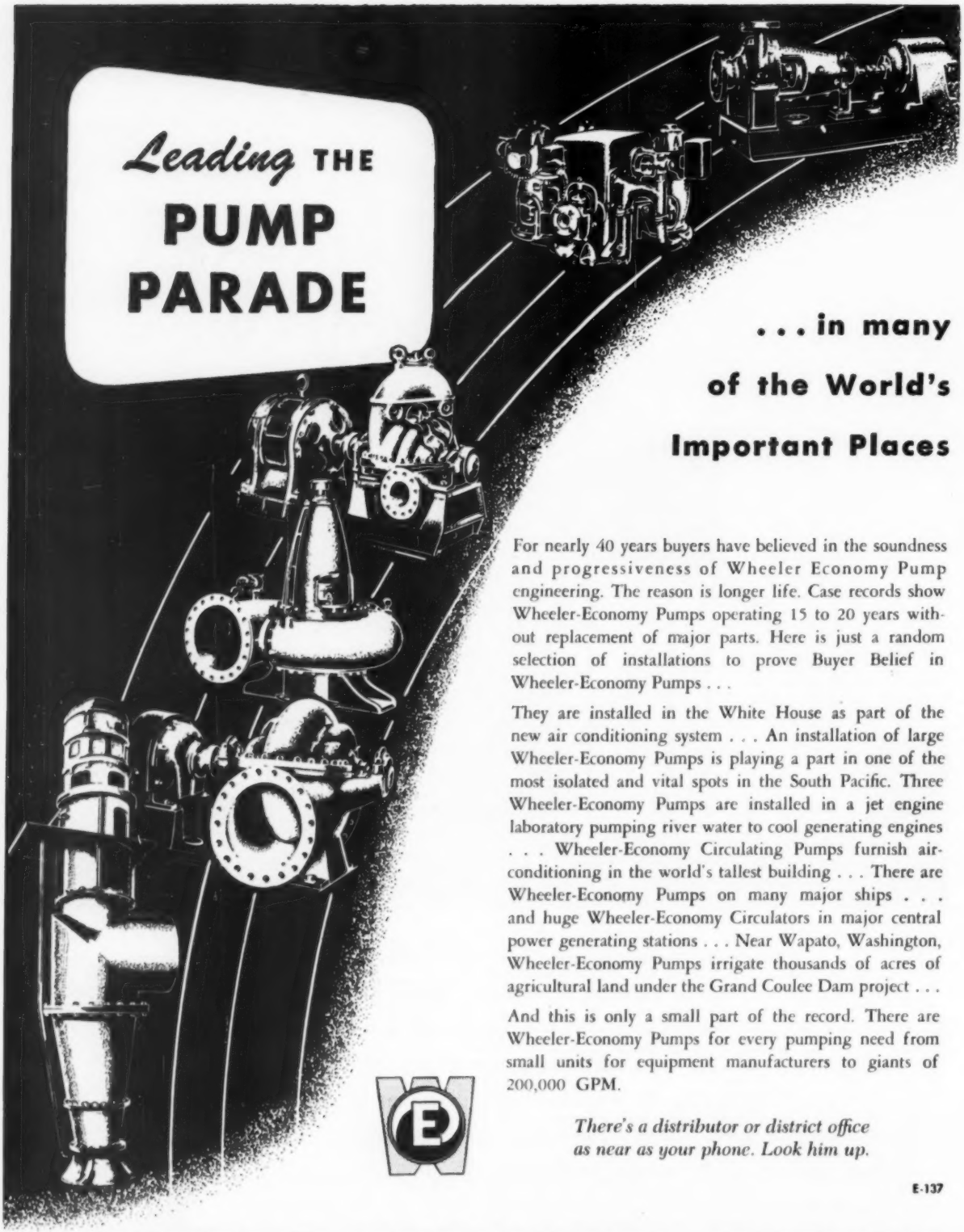


Leading THE
PUMP
PARADE

. . . in many
of the World's
Important Places

For nearly 40 years buyers have believed in the soundness and progressiveness of Wheeler Economy Pump engineering. The reason is longer life. Case records show Wheeler-Economy Pumps operating 15 to 20 years without replacement of major parts. Here is just a random selection of installations to prove Buyer Belief in Wheeler-Economy Pumps . . .

They are installed in the White House as part of the new air conditioning system . . . An installation of large Wheeler-Economy Pumps is playing a part in one of the most isolated and vital spots in the South Pacific. Three Wheeler-Economy Pumps are installed in a jet engine laboratory pumping river water to cool generating engines . . . Wheeler-Economy Circulating Pumps furnish air-conditioning in the world's tallest building . . . There are Wheeler-Economy Pumps on many major ships . . . and huge Wheeler-Economy Circulators in major central power generating stations . . . Near Wapato, Washington, Wheeler-Economy Pumps irrigate thousands of acres of agricultural land under the Grand Coulee Dam project . . .

And this is only a small part of the record. There are Wheeler-Economy Pumps for every pumping need from small units for equipment manufacturers to giants of 200,000 GPM.

There's a distributor or district office as near as your phone. Look him up.

E-137

WHEELER-ECONOMY PUMPS

ECONOMY PUMPS, INC. · DIVISION OF C. H. WHEELER MANUFACTURING CO.
19TH AND LEHIGH, PHILADELPHIA 32, PA.

For more data circle 546 on Post Card

What is your special packing problem?

- ☐ Pressure
- ☐ Maintenance
- ☑ Acids
- ☑ Alkalis
- ☐ Complicated inventory
- ☐ Temperature
- ☐ Petroleum products
- ☐ Food products

If it's handling acids and alkalis or other chemicals . . . use R/M Teflon Packings*

Raybestos-Manhattan manufactures a complete line of Teflon packings and gaskets. Teflon is not affected by chemicals within the temperature range of –80°F. to 500°F. No known industrial acids or caustics will attack Teflon; it has no known solvent.

R/M Teflon Packings and Gaskets are available in a variety of combinations for glass, glass-lined and stainless steel piping, and for pumps, valves and practically all kinds of fluid-handling equipment.

If you cut your own gaskets or fabricate parts like pump impellers and valve discs, order R/M Teflon in sheets, rods or tubes to specification. R/M Teflon Packings represent only one of the many different types of packing made by Raybestos-Manhattan. Whatever your packing problem, see your authorized R/M distributor. He has the answer for you.

R/M K-68—Compressed asbestos sheet.

R/M No. 303—Braided asbestos packing with Monel wire.

R/M versi-pak*—For general use.

R/M No. 920—Flexible metallic packing.

R/M Vee-Flex*—automatic packing rings.

*Du Pont trade-mark for its tetrafluoroethylene resin.

R/M

PACKINGS

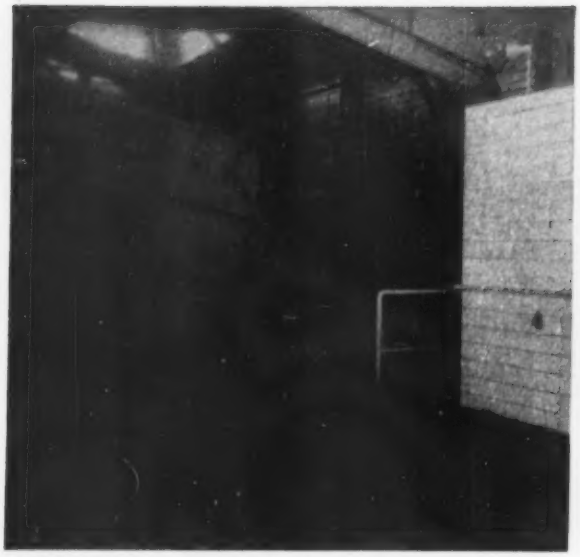
RAYBESTOS-MANHATTAN, INC.

PACKING DIVISION, MANHEIM, PA.

FACTORIES: Bridgeport, Conn., Manheim, Pa., Passaic, N.J., No. Charleston, S.C., Crawfordsville, Ind., Canadian Raybestos Co. Ltd., Peterborough, Ontario, Canada

RAYBESTOS-MANHATTAN, INC., Manufacturers of Packings • Teflon Products • Asbestos Textiles • Industrial Rubber Products • Abrasive and Diamond Wheels Rubber Covered Equipment • Brake Linings • Brake Blocks • Clutch Facings • Fan Belts • Radiator Hose • Sintered Metal Products • Bowling Balls

For more data circle 547 on Post Card



BEFORE—Johnson-March system turned off at car dumper of a large midwest utility. Compare this unretouched photo with the one at the right.

AFTER—Note absence of dust when Johnson-March system is operating at this same dumper. These systems have proved themselves in many plants. We'll be glad to furnish names.

STOP COAL DUST

at 1/10 the usual cost!

If you have a dust problem—no matter how large or small—no matter where the dust occurs . . . car dumpers, hoppers, crushers, belt galleries, or coal pile—it can be controlled or eliminated with a Johnson-March dust control system. Installation is fast, simple, and inexpensive. There is no interference with normal plant operations.

No ducts, no fans and no cumbersome equipment are required. Johnson-March compounds added to water and a carefully engineered spray system do the work. The system is guaranteed effective, but its operation is simple. It costs far less than other types of dust handling systems—in most cases only 1/10 as much. And maintenance costs next to nothing!

Even though you may have a mechanical dust collecting system, it will pay you to investigate a Johnson-March system.

Without cost or obligation, why not have one of our engineers discuss your dust problems with you? Just drop us a line or mail the attached coupon.

THE JOHNSON-MARCH CORP.
1724 Chestnut St., Philadelphia 3, Pa.
Without cost or obligation, I would like to know more about the Johnson-March system of low-cost dust control. PE-4

Name.....
Company.....
Address.....State.....
City.....

Johnson March

Specialists in Dust Control

1724 CHESTNUT STREET **Philadelphia 3, Pa.**

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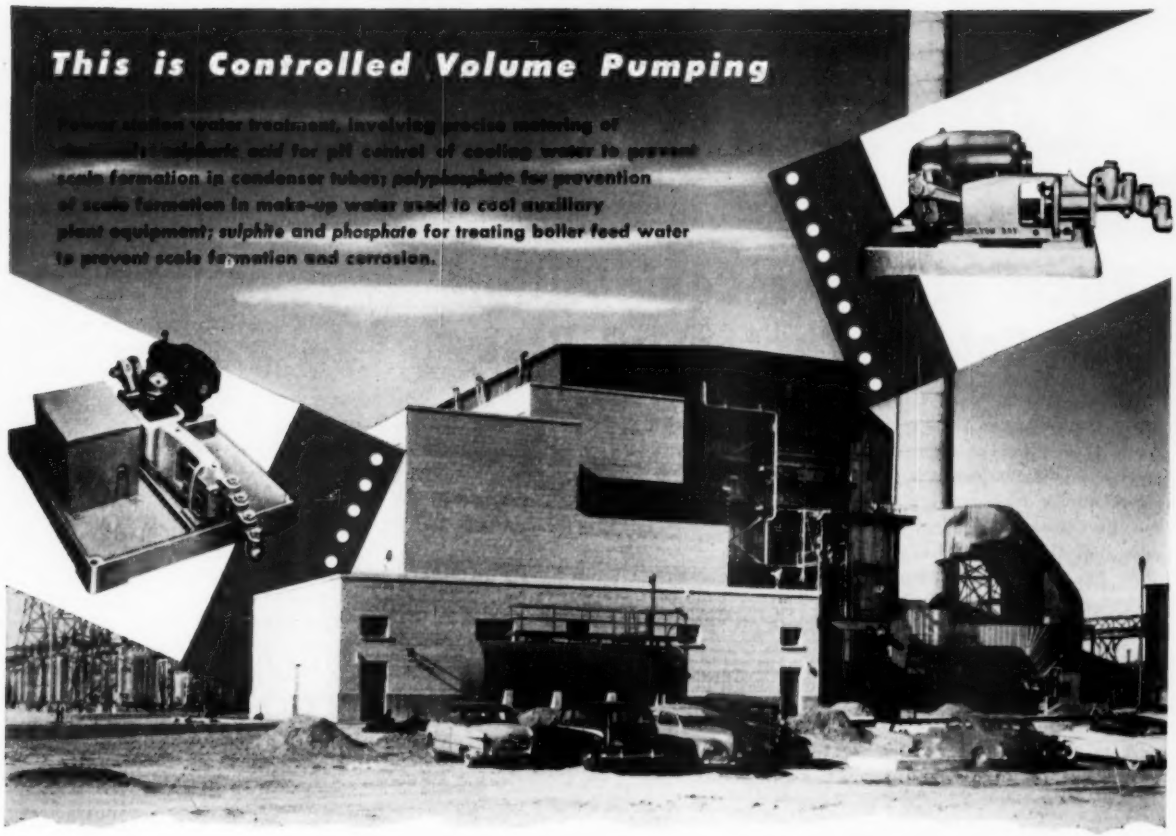
This is Controlled Volume Pumping
Power station water treatment, involving precise metering of chemicals: sulphuric acid for pH control of cooling water to prevent scale formation in condenser tubes; polyphosphate for prevention of scale formation in make-up water used to cool auxiliary plant equipment; sulphite and phosphate for treating boiler feed water to prevent scale formation and corrosion.

MILTON ROY CONTROLLED VOLUME PUMPS DO THE JOB . . .

At the Denver, Col., Arapahoe Power Station of the Public Service Company of Colorado, a three-fold water treatment problem is successfully resolved with use of Milton Roy Controlled Volume Pumps.

First, two Milton Roy Motor-Driven Pumps (one in stand-by service) meter 8.7 gph of sulphuric acid into supply water of a closed cycle stable heat system, for pH control to protect condenser tubes against scaling on their inner surfaces. A recording pH control unit automatically adjusts pump capacity by regulation of plunger stroke length. In this process a critical factor is the establishment of a pH balance between maximum scale prevention in the condensers and minimum delignification of a cooling tower structure. Arapahoe engineers report both the elimination of scaling at the condensers and achievement of optimum pH balance.

Scale prevention is also required in make-up water since that water is first used to cool auxiliary equipment of the plant before being injected into the main circulating system. For this purpose, a Milton Roy Simplex Motor-Driven Pump is employed to meter a pre-set volume of polyphosphate into the water at the intake pipe. A similar set-up is used in treating feed water for boilers. Two Milton Roy Simplex Motor-Driven Pumps, arranged in parallel, feed sulphite into the drum for scavenging oxygen. Another pair meters phosphate for prevention of scaling.

Operation of all seven pumps is reported to be reliable and accurate, with no special maintenance problems existing.

Their performance at Arapahoe demonstrates the versatility and dependability of Milton Roy Controlled Volume Pumps. As motor-driven or air-powered units, as components of automatic systems complete with a variety of automatic controls and accessory equipment, these pumps provide the accuracy and dependability so vital to uninterrupted power generation service.

Wherever precise metering of chemicals is required, there's a Milton Roy Controlled Volume Pump to do the job. Milton Roy also supplies systems for all forms of internal and external water treatment, to meet all pressure and capacity requirements. For additional information write us, or get in touch with the Milton Roy representative listed in your classified telephone directory.

Manufacturing Engineers

WITH THE EXCLUSIVE SIVER-VALVE DESIGN

MILTON Roy COMPANY

1320 EAST MERMAID LANE, PHILADELPHIA 18, PA.

CONTROLLED VOLUME PUMPS AND AUTOMATIC CHEMICAL FEED SYSTEMS

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BRIDGEPORT BRASS COMPANY
CONDENSER AND HEAT EXCHANGER TUBE EDITION
COPPER ALLOY BULLETIN
"Bridgeport" BRASS CO. MILLS IN BRIDGEPORT, CONN. AND INDIANAPOLIS, IND.—IN CANADA: NORANDA COPPER AND BRASS LIMITED, MONTREAL

Effect of Water Composition and Copper Content of Brass

In the previous issue of the Copper Alloy Bulletin, we discussed various types of dezincification – plug type, layer type, intercrystalline, and Beta phase attack. Now we will deal with the effect of water composition and the part that the copper content of the alloy plays in regard to the corrosion resistance of brass.

Nonscaling Waters Are Corrosive

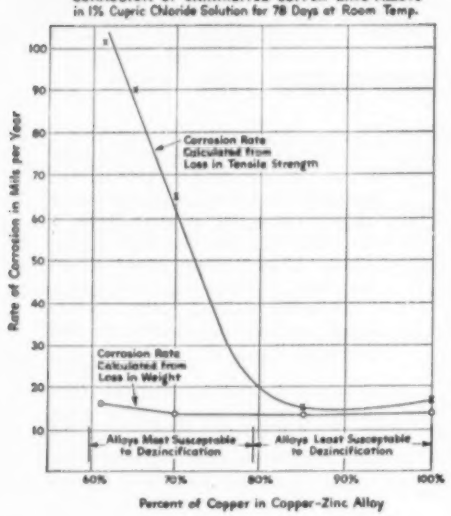
Dezincification and pitting are most likely to occur in nonscale-forming fresh or salt waters. In such waters copper-base alloys which are resistant to dezincification such as Red Brass and inhibited brasses, Arsenical Muntz, Arsenical Admiralty and Arsenical Aluminum Brass should be used. The other alternative is to hold the mineral balance in the water at such a level that it will be slightly scale-forming.

Effect of pH Values

Dezincification can occur in both fresh and salt waters with the pH ranging from 1.0 to 8.0 or higher. The pH value in itself is not particularly significant. It can, however, become very important where adjustment in the pH may lead to mineral scale formation or the dissolving of mineral scales.

In such media the tendency of plug-type dezincification is more marked in the higher pH range and the tendency for general dezincification is greater in the lower pH range, with a rather broad twilight zone in the central section of the pH scale.

CORROSION OF UNINHIBITED COPPER-ZINC ALLOYS
in 1% Cupric Chloride Solution for 78 Days at Room Temp.



Resistance of Copper-Zinc Alloys Varies with Copper Content

Our laboratory tested the effects of corrosion on uninhibited copper-zinc alloys and copper in 1% cupric chloride solutions at room temperature over a period of 78 days. 1% cupric chloride solution was used because the accelerated corrosion in this medium is comparable to that obtained in sea water over a much longer period.

The depth of corrosion was determined both on the basis of loss in weight and loss in tensile strength which were plotted against the copper content of the copper-zinc alloy tested. The curve for corrosion rate based on loss in tensile strength drops rapidly with increasing copper content and flattens out at 85% copper.

The wide difference between the depth of corrosion based on loss of tensile strength and loss in weight for the alloys tested is due to dezincification which leads to only a relatively small loss in weight but a large loss in tensile strength. The converging of the two curves indicates that where the copper content is 85% or higher, dezincification is not likely to occur.

Arsenic Also Inhibits Dezincification in Cupric Chloride

Other corrosion tests, conducted in 1% cupric chloride solutions, revealed that a small percentage of arsenic or other inhibitors alloyed with brasses containing less than 85% copper increased their resistance towards dezincification.

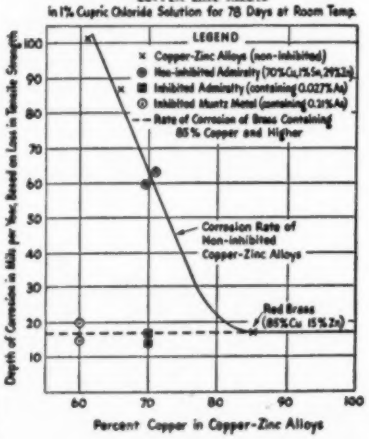
The corrosion rate of the arsenical brasses tested dropped to approximately the same level as that of the uninhibited brasses containing 85% or more copper.

The addition of 1% of tin to brass (Admiralty metal–70% Cu, 29% Zn, 1% Sn), under the conditions of testing, has very little effect on the extent of dezincification. However, Admiralty metal containing 0.027% arsenic and Muntz metal (60% Cu, 40% Zn) containing 0.21% arsenic were practically equal to Red Brass (85% copper, 15% zinc).

Laboratory Service

The above tests clearly indicate the importance of using a dezincification inhibitor such as arsenic, in brass, in order to reduce corrosion attack. By specifying the correct alloy for the manufacture of products exposed to water solutions and weathering, considerable reduction in corrosion's toll can be effected. Contact Bridgeport's nearest district office for your metal requirements and help on your metal problems. (9264)

CORROSION RATE of INHIBITED and NON-INHIBITED COPPER-ZINC ALLOYS
in 1% Cupric Chloride Solution for 78 Days at Room Temp.



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DETROIT ROTOGRATE

REDUCES COAL COST

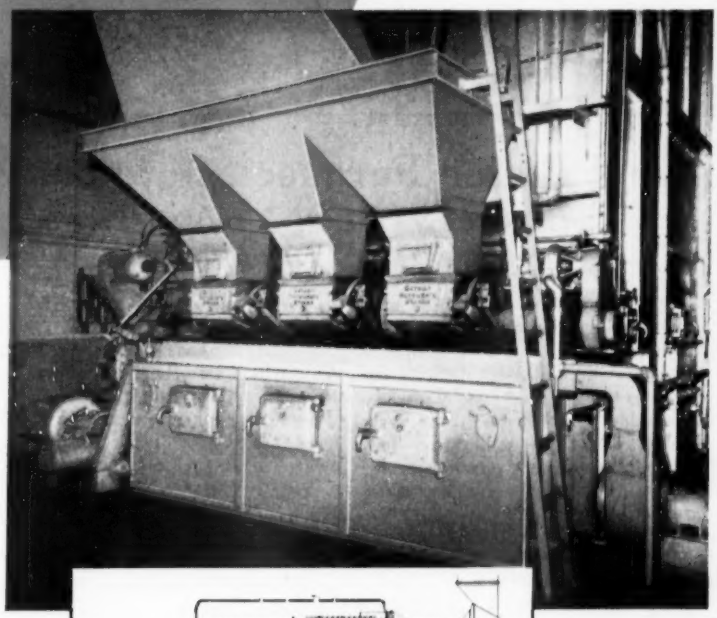
12.6 CENTS PER 1000 POUNDS OF STEAM

AT

Certain-teed Products Corporation

York Pennsylvania Plant

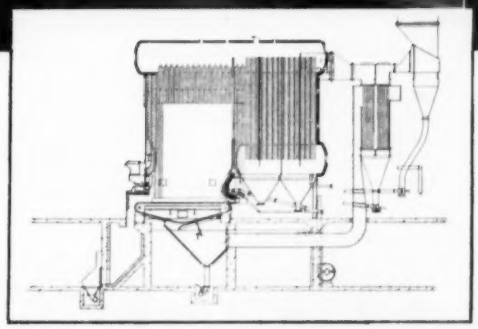
Also Capacity Increased By 479 Tons of Product



Detroit RotoGrate Stoker with Erie City Type VL Boiler at Certain-teed Products Corporation, York, Pa. Capacity 45,000 pounds steam per hour. Operates with preheated air.

THIS Detroit RotoGrate Stoker fired unit has reduced fuel cost 12.6c per thousand pounds of steam at Certain-teed Products Corporation plant at York, Penna., according to report by Mr. W. M. Noon, Combustion Engineer. The reduction in steam cost was made at the same time plant capacity was increased.

The Detroit RotoGrate will save you money and improve your operation. It is the original spreader stoker with forward moving grates that discharge the ash at the front. It handles fluctuating as well as steady loads with high thermal efficiency. • You too can save money with Detroit Stokers. Write for Bulletin.



DETROIT SINCE 1898 STOKERS

DETROIT STOKER COMPANY

General Motors Building — Detroit 2, Michigan

District Offices in Principal Cities • Works at Monroe, Michigan

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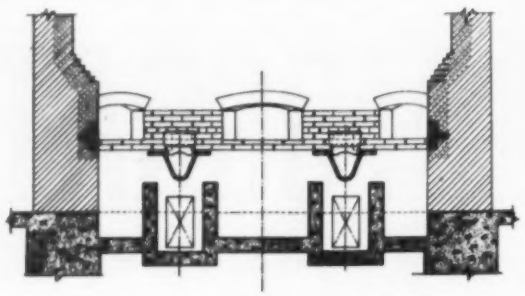
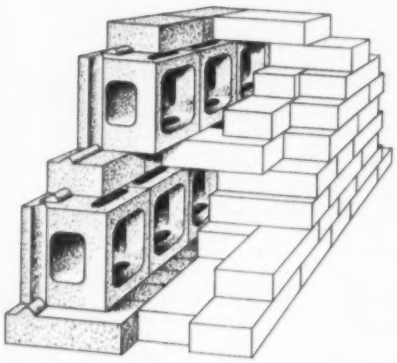


CRYSTOLON
Solid Brick
Construction



CRYSTOLON
Air-Cooled
Block
Construction

Avoid Boiler Furnace Shutdowns...

with CRYSTOLON refractories protecting the "Trouble Zone"*

With the right kind of wall protection in your boiler furnaces, you cut shutdowns and maintenance costs to a minimum.

Norton CRYSTOLON (silicon carbide) refractory shapes — solid bricks or hollow air-cooled blocks — form a real "safety belt" for this trouble zone. That's because they offer outstanding protection against these three frequent causes of furnace failure:

High Heat. CRYSTOLON shapes are so highly refractory that they withstand temperatures up to 3100 F.

Slag Penetration. CRYSTOLON bricks and blocks, made with a maximum percentage of silicon carbide, are so structurally dense that even when clinkers adhere — which happens very rarely — they can be easily removed.

Abrasion. CRYSTOLON silicon carbide, being a tough abrasive itself, is not noticeably affected by the abrasion of the moving fire beds of stoker-fired furnaces.

Why waste time, trouble and money on refractories that spall, erode or crack? Investigate how quickly CRYSTOLON shapes pay for themselves with trouble-free service.

Norton RA1019 ALUNDUM* Cement adds extra life to furnace walls

One way to assure long lasting boiler furnace walls is to lay up your brick with Norton RA1019 ALUNDUM cement. Containing 80% fused alumina, this fine-ground, chemically stable cement matures at 1850 F and resists temperatures up to 3100 F — qualities that mean strong, thin, firmly sealed joints in both silicon carbide and fused alumina brick.

*Trade-Marks Reg. U. S. Pat. Off. and Foreign Countries

NORTON

Special REFRACTORIES

Making better products to make other products better

NORTON COMPANY, WORCESTER 6, MASSACHUSETTS

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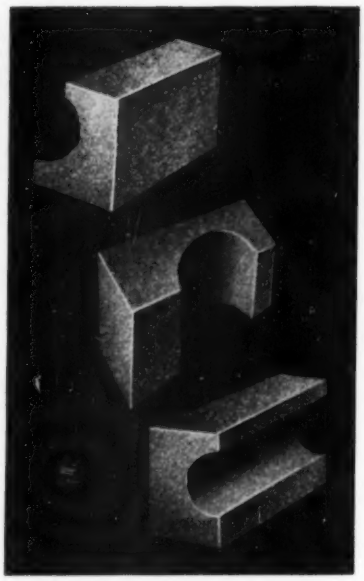

CRYSTOLON Armor Blocks in your water tube boilers give low-cost protection against high heat

High refractoriness that stands up under today's increasing boiler furnace temperatures is just one big advantage of Norton CRYSTOLON Armor Blocks. In addition, they have great resistance to slag penetration and abrasion — plus the high thermal conductivity that promotes even heat distribution and affords maximum protection to tubes from localized heat generation and flame impingement.

Installation is easy and inexpensive. Adjoining surfaces of blocks are tapered, for secure locking and intimate contact with tubes. Bent or straight tube sections can be replaced from the fire side and are laid dry, further reducing installation costs. Tubes require no cleaning or grinding.

For prices and full information, send data on tube diameters, tube spacing, radius of curvature of bent sections and areas to be curved.

Know the Facts

These two Norton bulletins contain plenty of valuable information on the properties and selection of both refractory brick and cement. Ask your Norton Representative for Bulletins 862 and 863, or write direct to NORTON COMPANY, 611 New Bond Street, Worcester 6, Mass. *Canadian Representative:* A. P. Green Fire Brick Co., Ltd., Toronto, Ontario.

Right on the nose

Specify **SCOVILL** PHOSPHORIZED

ADMIRALTY HEAT EXCHANGER TUBES

The "hot tip" that produces a winner in heat exchanger tube applications need not be just a lucky guess. With Scovill men and methods behind you, you can be in the money practically every time.

The fact is that Scovill Heat Exchanger Tube Technical Service is considered by many to be the most competent and experienced in its field. Scovill Phosphorized Admiralty Heat Exchanger Tube is also definitely out of the ordinary because it is hot-extruded from our Continuous-Cast Billets. Continuous Casting assures uniformity in chemical composition and optimum inhibitor (phosphorus) content . . . means a dependably better tube, especially for service with contaminated or brackish circulating water.

Because Scovill makes a wide range of the most popular Heat Exchanger tube alloys, we can be completely impartial in making recommendations for your particular applications. Inquiry outlining your problems is invited. A 40-page technical booklet will be sent on request. For complete information, contact: Scovill Manufacturing Company, 99 Mill Street, Waterbury 20, Conn. Phone Waterbury 4-1171.

SCOVILL
HEAT EXCHANGER TUBE ALLOYS

•

PHOSPHORIZED ADMIRALTY
ADMIRALTY
ARSENICAL ADMIRALTY
MUNTZ METAL
NAVAL BRASS
RED BRASS, 85%
DEOXIDIZED COPPER
ARSENICAL COPPER
COPPER NICKEL, 10% & 20%
CUPRO-NICKEL, 30%
CUPRO-NICKEL, 30% (High Iron)
ALUMINUM BRASS
ALUMINUM BRONZE, 5%
DUPLEX TUBE

SCOVILL

"You can't buy better Brass"

39C53

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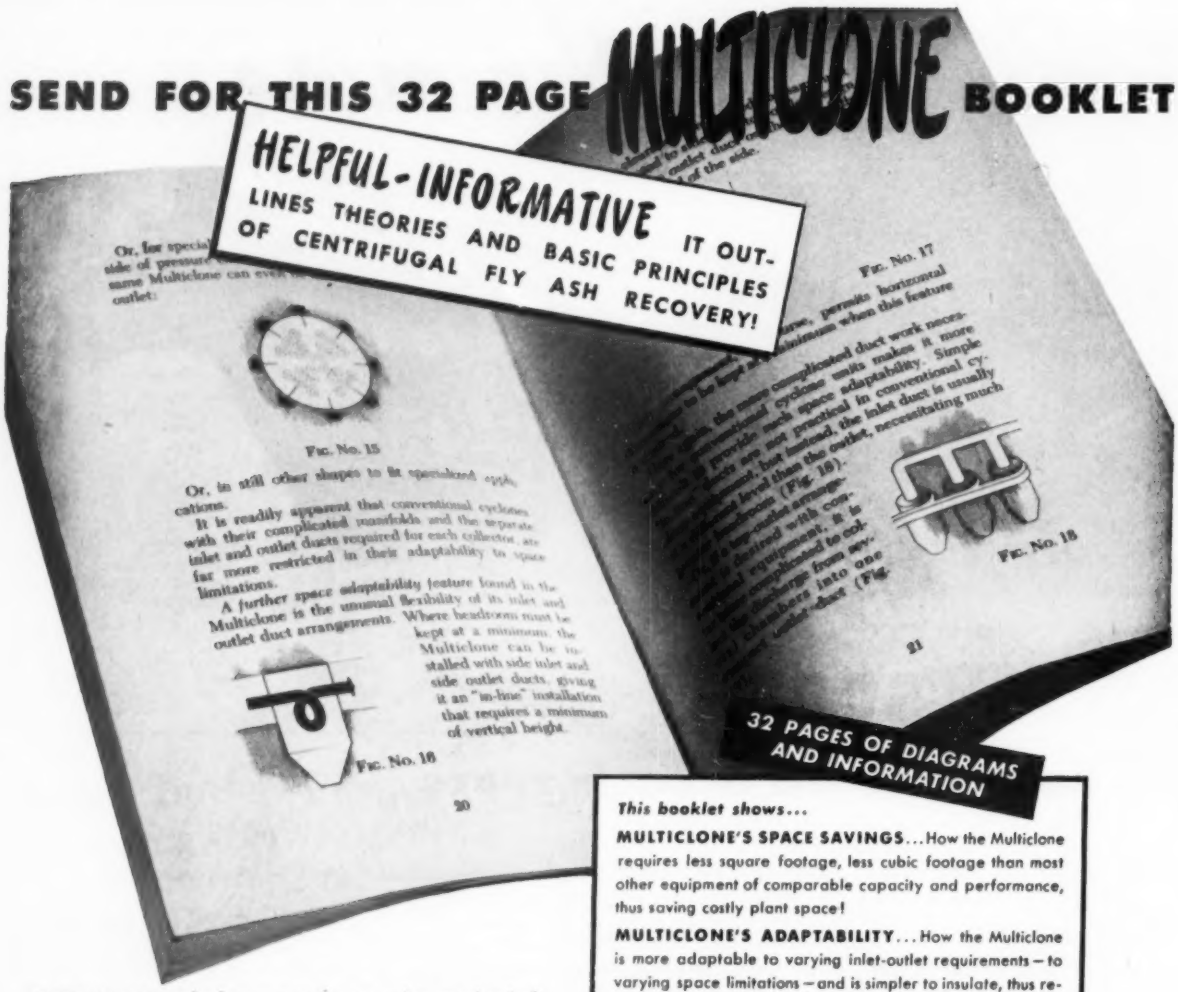
SEND FOR THIS 32 PAGE MULTICLONE BOOKLET


HELPFUL-INFORMATIVE IT OUT-LINES THEORIES AND BASIC PRINCIPLES OF CENTRIFUGAL FLY ASH RECOVERY!
FIG. No. 15
FIG. No. 16
FIG. No. 17
FIG. No. 18
20
21
32 PAGES OF DIAGRAMS AND INFORMATION

NO MATTER whether you are now using mechanical dust recovery equipment or are planning the installation of such equipment at some future date, here is a booklet that is full of helpful and valuable information on centrifugal dust recovery. It not only explains the basic methods and principles involved, but also shows the important differences between small and large diameter separating tubes, shows how to simplify your duct work and reduce installation costs, and outlines many other important factors to be considered in selecting mechanical dust recovery equipment.

In addition, this informative booklet illustrates and explains how MULTICLONE'S unique *vane* design is fundamentally different...how it makes possible greater compactness, simpler installation, high recovery of the small particles as well as the medium and coarser ones, and many other facts on MULTICLONE advanced design.

A limited supply of these booklets is available for free distribution to those interested in mechanical recovery equipment and methods. Write for your copy today.

This booklet shows...

MULTICLONE'S SPACE SAVINGS...How the Multiclone requires less square footage, less cubic footage than most other equipment of comparable capacity and performance, thus saving costly plant space!

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MULTICLONE'S LOW MAINTENANCE...How the Multiclone has no high speed moving parts to repair or replace, no pads or filters to clean or renew, nothing to choke gas flow or increase draft losses as suspended materials are recovered. Multiclone draft losses remain uniformly low—recovery efficiencies uniformly high—at all times!

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slasher production increased...

by slashing heat-up time

A South Carolina mill reports (after equipping a slasher with Yarway Impulse Steam Traps) . . . "For the first time we are actually getting production . . . due to slasher heating up faster on the start and at 'doff' periods."

This same mill also reports *even temperatures* on their dry cans — only 2° or 3° variance — compared to as much as 15° with the old-type traps. They are now standardizing on Yarway Impulse Traps.

Cases of increased production are common where Yarway Impulse Steam Traps are used. They are designed to insure sending maximum premium B.T.U.'s at top temperatures into your process or product . . . to *get equipment hotter, sooner and keep it hot.*

Enjoy these benefits, and others like *easy installation, reduced maintenance* and *low cost,* by trying Yarway traps in your plant. Stocked and sold by 216 Industrial Distributors. Trained Yarway men also are quickly available to help on your trap problems.

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the steam trap designed with more production in mind

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EXTRACTION TURBINE

(*Continued from page 58*)

Example 3

At a given load, the greatest amount of high-pressure steam can be admitted when the exhaust flow and intermediate section flow are at their maximum values.

Example 3 is a step method for calculating the maximum high-pressure admission flow at a given load with maximum flow to exhaust.

It is a solution of the equation,

$$F_H = F_L \frac{(1 - f_L)}{(1 - f_H)} + \frac{(F_o - F_o)}{(1 - f_H)} \qquad (f)$$

Equation (f) is a rearrangement of

$$F_o = F_o - (F_H \times f_H) + (F_L \times f_L) + F_H - F_L \qquad (g)$$

Note that f_H is high-pressure admission factor and f_L is low-pressure extraction factor.

In Example 3, F_o is the maximum flow to exhaust without a pressure rise and is equal to the non-extraction throttle flow at 7500-kw load.

The maximum 150-psig admission flow is equal to the maximum intermediate section flow, which is usually calculated at full load with "total" low-pressure extraction flow and zero high-pressure extraction or admission flow.

Maximum intermediate flow =

$$\left[\frac{\text{(Non-extraction flow at 4/4 load} - \text{Min. exh. flow)}}{(1 - \text{Extraction factor, LP})}\right] + \text{Minimum exhaust flow}$$

The maximum low-pressure extraction flow is equal to the maximum intermediate flow minus the maximum exhaust flow.

These three examples give data that are slightly approximate. However, decisions regarding steam conditions may be satisfactorily made from comparison of evaluations worked up from these data.

DEIONIZATION

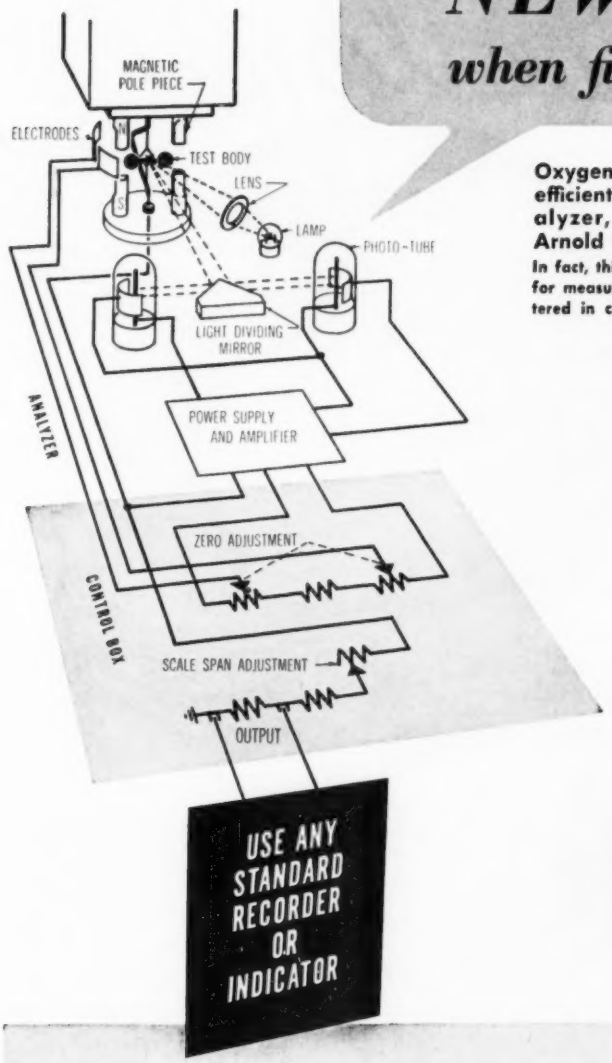
(*Continued from page 61*)

Uninterrupted operation of the plant since December 15, 1950, has been rather remarkable, in the opinion of engineers who man it. Treated water was being used within three days after piping was completed. After about 10 days of fairly wide fluctuations in run lengths on all units, the runs became steady and have remained so, their length predictable within an hour or two. On average water, each cation unit requires regeneration every 22 hr, each anion unit every 35 to 40 hr. Thus, when operated at the designed flow rate, a cation unit comes up for regeneration about once every 5 to 6 hr and an anion unit every 8 to 10.

The operator knows from his log sheet about when he may expect a breakthrough on each cation unit. His first indication comes from a rise in conductance curves of all the anion units on the line. At this point, the effluent sodium concentration of

(*Continued on page 117*)

NEW SAVINGS
when firing with any fuel...



Oxygen content in flue gases has proved to be *the* criterion of efficient combustion. Need for a rugged, accurate oxygen analyzer, requiring little maintenance, has resulted... the Arnold O. Beckman Oxygen Analyzer meets this need.

In fact, this is the *only* oxygen analyzer that employs a direct, physical method for measuring oxygen content in gases, thereby eliminating difficulties encountered in conventional secondary methods of measurement!

The Outstanding Advantages of the Arnold O. Beckman Oxygen Analyzer stem from the fact that oxygen is extremely paramagnetic (drawn *into* a magnetic field), whereas other common gases with few exceptions are diamagnetic (repelled *out* of a magnetic field).

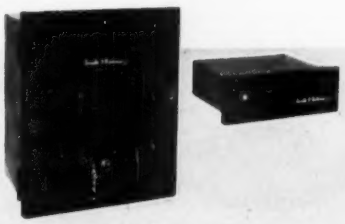
As indicated at left, the only moving part in this instrument is a small test body suspended in a magnetic field. Sample gas passing around this body causes it to rotate into or out of the magnetic field, depending upon the oxygen content of the gas. A beam of light, reflected from a mirror attached to the test body, permits recording the result by simple electrical circuits on *any* standard recorder or indicator. *This measurement is purely physical—not a chemical analysis—and is accomplished without recourse to filaments, catalysts, chemicals, fuels, cams, glassware, etc. which require replacement or adjustment.*

The sensitivity and accuracy of the Arnold O. Beckman Oxygen Analyzer surpass that of any other method of oxygen determination. Its simplicity eliminates practically all maintenance. It is completely automatic in operation. Variety of ranges is greater than obtainable by any other commercial analyzer, and multi-range instruments are available.

Even sampling is simpler. The unique principle of this instrument makes possible a completely new approach to sampling systems—rugged, simple, trouble-free!

Get the full story on the many ways the Model F-3 Analyzer and Sampling System can benefit *your* operations. Write for Data File 3D-231

Features of the Beckman Model F-3



SELECTIVITY Highly sensitive to oxygen. Effects of gases other than oxygen are negligible.

MANY RANGES Combustion ranges include 0-5%, 0-10%, 0-15%, and are provided with a second range of 0-25%. Other ranges up to 0-100% O_2 are available. Calibration of the Model F-3 is strictly linear and scale is accurate over the entire range.

HIGH ACCURACY ±1% of full scale for spans of 5% and greater. Accuracies within .05% O_2 on 0-5% range are available.

AIR CHECK Simple positive check of proper operation by recording the air point on the second range.

SIMPLE SAMPLING Independent of flow rate. Nothing is added to the sample. The sample may be dry or saturated. Corrosive gases will not poison the instrument. Only a small sample (3-15 cu. in./min.) is required.

LOW MAINTENANCE Completely insulated against extreme shock and vibration. No chemicals, no catalysts to replenish. No wicks, filaments, orifices, valves, etc., to clean and replace.

STANDARD RECORDERS Any standard industrial potentiometer recorder or pneumatic receiver can be used.

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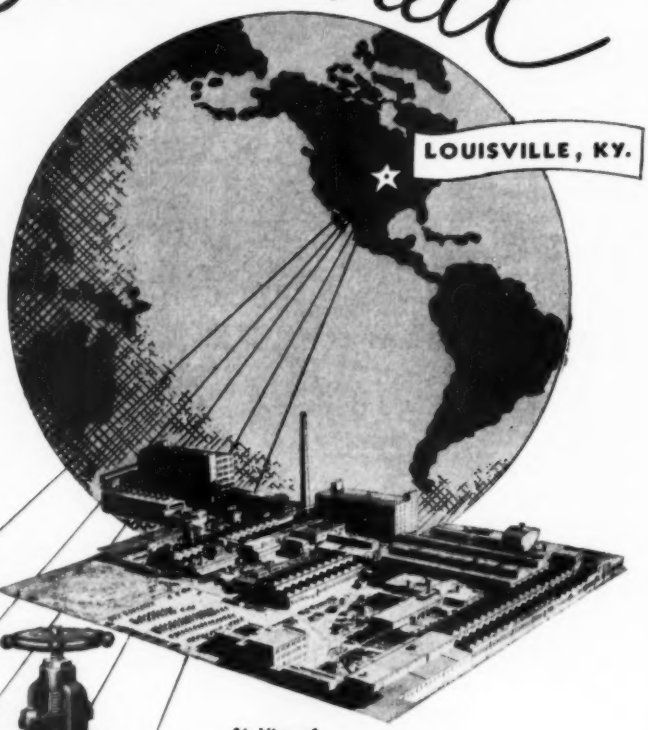

Air View of
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(*Continued from page 114*)

the cation unit which is due to break through is checked by means of a flame photometer. When the average flow rate is low, a freshly regenerated unit is kept on standby to replace the exhausted unit. When all four units are on stream, a constant flow to the service is maintained by increasing the flow on the three remaining units while the exhausted unit is out of service.

During regeneration, the units are backwashed and then treated with acid. After the acid has been introduced, it is displaced with raw water. After displacement is complete, the unit is rinsed until the conductance of the effluent approaches that of units on the line. Sodium concentration is then checked; and, if it confirms completion of rinsing, the unit is put into service.

Anion unit breakthrough is determined by photoelectric colorimeter measurement of silica in the effluent water, when breakthrough is anticipated. The unit is taken off the line when silica in the effluent reaches 0.3 ppm.

WASTE WATER

Waste water treatment is handled in three rectangular compartments of concrete, lined with acid resistant material, and located below the floor of the building. Two of these pits, each holding approximately 100,000 gal, are used for blending and neutralizing. The third holds 30,000 gal of city water. Uniformity of blending is shown on a pH meter. When a constant pH of 7 to 9 is attained, the contents are valved into the sewer. If the pH lies outside those limits, the operator titrates to determine the acid or alkali required for neutralization, and blends in the calculated amount. In practice, this step is seldom required because established dosages generally provide adequate neutralization.

Throughout the plant, careful planning of safety measures is evident both as to equipment and the training of men who, it should be emphasized, are selected, top-grade operators.

In the words of engineering men in the utility company, operating experience with both the deionizing equipment and in the power station has been "very satisfactory." Concentration of the boiler water is being held to 600 ppm, and blowdown is substantially identical with that when condensate was being fed to the boilers and evaporators were supplying 1 per cent make-up.

On the basis of the performance of this plant, company engineers are continuing their study of resin deionization for future needs. For the company's next two steam-generating stations, now being designed, Amberlite Monobed deionizers have been selected. Unlike the present installation, those units involve the use of both cation and anion exchangers

(*Continued on page 119*)

BIDDLE *Instrument News*

IF YOU MEASURE *SPEED*
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***If you want*—Readings of**
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—choose one of the several ranges available in **Jagabi® Chronometric Speed Indicators** from 0-100 up to 0-100,000 rpm. The shaft or spindle is set in ball bearings. No lubrication needed. Design and construction of these instruments is such that a minimum of maintenance is required even in constant, severe service.

The **Jagabi Tachoscope,** stop watch and revolution counter, is also recommended for high accuracy work. **BULLETIN 35-PE.**

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. . . select the **Jagabi® Centrifugal Tachometer**—speed ranges 25 to 48,000 rpm. Three—and five—ranges in one instrument . . . or the **Dr. Horn Tachometers** which are made with 6 ranges between 25 and 30,000 rpm. Both Jagabi and Dr. Horn Tachometers have a special friction coupling which minimizes the damaging effects of too fast acceleration and over-speeding. Results: Low maintenance and long, dependable service life, for direct indicating, rpm shaft or fpm linear and peripheral speeds and speed variations. **BULLETIN 35-PE.**

If you want*—QUICK and ACCURATE RPM READINGS with *SAFETY

. . . Consider the advantages of **Frahm® Resonant Reed Tachometers** for hand use or permanent mounting.

No contact with moving parts is required. Just touch the instrument to the chassis, frame or housing of the machine or motor and read the rpm directly. No moving parts. No lubrication or maintenance required. Accurate to ½ of 1%, they will operate continuously for years without any appreciable change. Instruments with limited ranges available for as little as $27. Practically any desired range within 900 and 100,000 rpm can be supplied. **BULLETIN 31-PE.**

B-812

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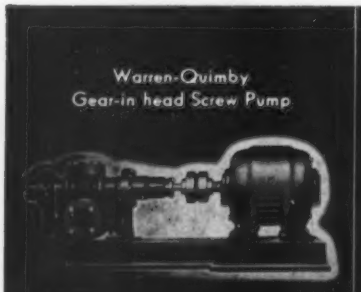
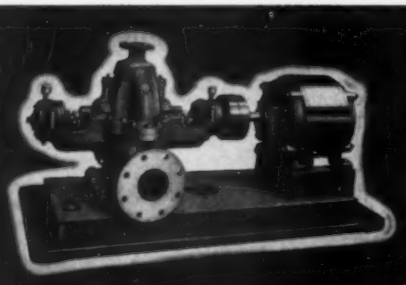
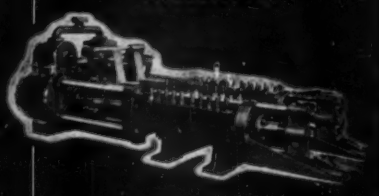


Warren-Quimby Gear-in head Screw Pump

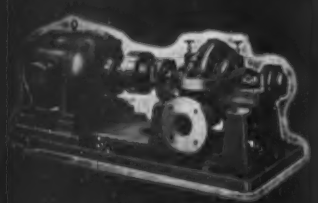


Warren Condensate Pump



Warren Horizontal Duplex Hydraulic Pump

Warren Type "L" Single-Stage Single-Suction Liquor Pump

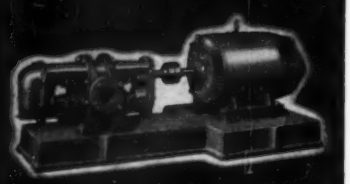


Warren Type DBL, Single-Stage Double Suction, Centrifugal Pump

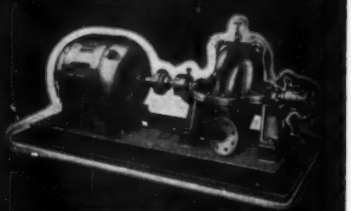
There's a Warren or Warren-Quimby Pump for practically all industrial pumping applications, and our large variety of types and sizes assures an unbiased recommendation. The value of this should not be underestimated because a recommendation that barely meets operating conditions and requirements can prove to be anything but a profitable long range investment, regardless of any initial advantage in cost.

It will pay you to check with Warren on your next pumping job.

P-87



Warren-Quimby External Gear and Bearing Rotex Pump



Warren Two-Stage Volute Centrifugal Pump

WARREN QUIMBY PUMPS

WARREN STEAM PUMP COMPANY, INC.

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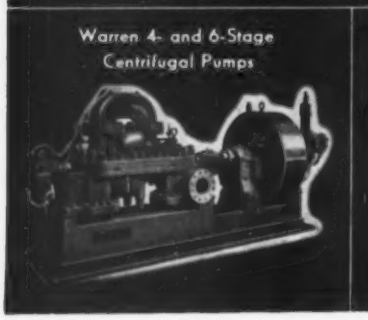
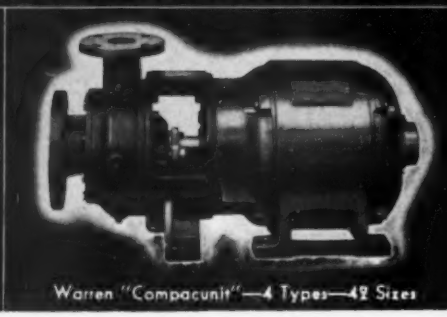
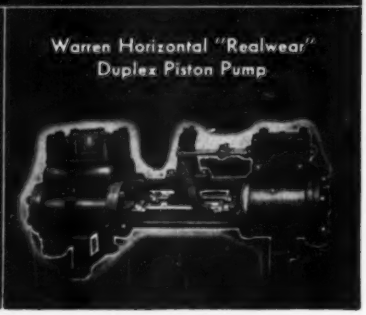


Warren 4- and 6-Stage Centrifugal Pumps



Warren "Compacunit"—4 Types—42 Sizes



Warren Horizontal "Realwear" Duplex Piston Pump

For more data circle 560 on Post Card

(*Continued from page 117*)
in a single column. This will permit major economies in the cost and size of the equipment, and will deliver an effluent of even higher quality. These units will provide make-up for 1800-psi boilers.

NEW BOOM INTAKE

(*Continued from page 63*)
mechanical trash lifting devices, gates, guides and ladders. Concrete boot can be built at about 30 per cent of the cost of an average deep screen chamber.

While the conventional type intake screens extend to the river bottom, the boom intake has its lowest screening point well above river bottom, avoiding mud and water-soaked material. After a storm the river bottom takes longest to settle and clear; it is apparent that the boom intake operating above the bottom will deliver cleaner water. A natural function of the boom intake is to repel trash rather than attract it like conventional intakes, since the screen moves outward into the river, pushing back heavier debris. Trash adhering to the screen bottom encounters a downward spray at the outer end of the screen where gravity helps in removal. By the same tendency, heavy water-logged material drifting downstream below the screen would be prevented by gravity from rising to the screen. With the conventional intake this material would be drawn sidewise into the screen chamber and trapped there.

Another advantage of the new intake is that it is largely shop fabricated, saving installation time. Construction of the concrete boot requires about one-third less cofferdam and pumping and can be built over a low water period of the river. On existing installations enormous quantities of form work, concrete and reinforcing steel involved in construction of screen chambers requires many months to build, often extending into the high water period with great hazard of flooding out the work. Upon completion of the boot the assembled screen unit is lowered into guide slots provided in the boot. No underwater fastenings are required.

Ice, Fish No Problem

In northern installations there is the old problem of winter ice. Here we must retain the conventional recirculating pipe or tunnel, introducing warm water just upstream of the intake. While forming of needle ice on grills and screens has long troubled operators, complete elimination of the grills on the boom intake serves to reduce trouble from this source. Block ice problems which in some localities hamper conventional operation by obstructing entrance openings, are reduced by a row of protective piles placed ahead of the intake. It should also be noted that in localities where driftwood abounds, the usual log float must be employed to

(*Continued on page 120*)

DARTS FIT TIGHT, STAY TIGHT because spherical grinding finishes the seats to a true ball joint with wide, true-bearing surfaces. Darts are easily made tight without jamming. They can be used on installation after installation without scarring the seats.

QUICK FACTS

- **TWO BRONZE SEATS** of special alloy offer extra resistance to pitting and corrosion. They provide years of leakproof protection.
- **PRACTICALLY INDESTRUCTIBLE** Dart bodies and nuts consist of top-quality, air-refined malleable iron for extra resistance to stress and stretching.
- **TOUGH, HEAVY SHOULDERS** can take the most severe wrenching without damage.

These features make Darts your best union buy...they assure trouble-free performance year after year.

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STEAM and MECHANICAL ATOMIZATION

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NATIONAL AIROIL
DUAL STAGE
OIL BURNER

Now, at last, the inherent advantages of *both* systems of fuel oil atomization are *profitably* yours . . . within the one, new NATIONAL AIROIL Dual Stage Burner.

41 years of combustion equipment design and manufacture are in back of the Dual Stage Oil Burner . . . and, it has been thoroughly tested and proved in the field for firing: Petroleum Processing Heaters; Rotary Kilns; H.R.T., Scotch Marine and Water Tube Boilers; etc.

Available in three sizes, the NATIONAL AIROIL Dual Stage Burner fires all grades of fuel oil from No. 2 to No. 6, with a ready capacity of 80 to 300 g.p.h. Further, for a perfect flame pattern, we would recommend using with the Dual Stage Burner either the NATIONAL AIROIL Universal Register for forced draft or, the NATIONAL AIROIL Tandem Unit for natural or induced draft furnaces.

Get detailed description, illustration, and specifications in NATIONAL AIROIL Bulletin 25.

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INDUSTRIAL OIL BURNERS, GAS BURNERS, FURNACE EQUIPMENT

For more data circle 562 on Post Card

(*Continued from page 119*)

keep driftwood clear of the intake.

Then there is the problem of fish. Drawn through entrance grills of the conventional screen chamber, they impinge upon the traveling screen and are carried upward. As the screen rises many fish fall back into the water — this process being repeated until the fish, lying complacent on the basket ledge, are carried to the surface and disposed of by the sprays. The New York *Times* on December 7, 1952, carried an account of a near shut down at the Glenwood Plant of the Long Island Lighting Co. in which great quantities of fish, trapped in the intake and blocking the screen, caused a head differential which broke several screen baskets. Extra crews on 24-hr duty managed to keep the plant running.

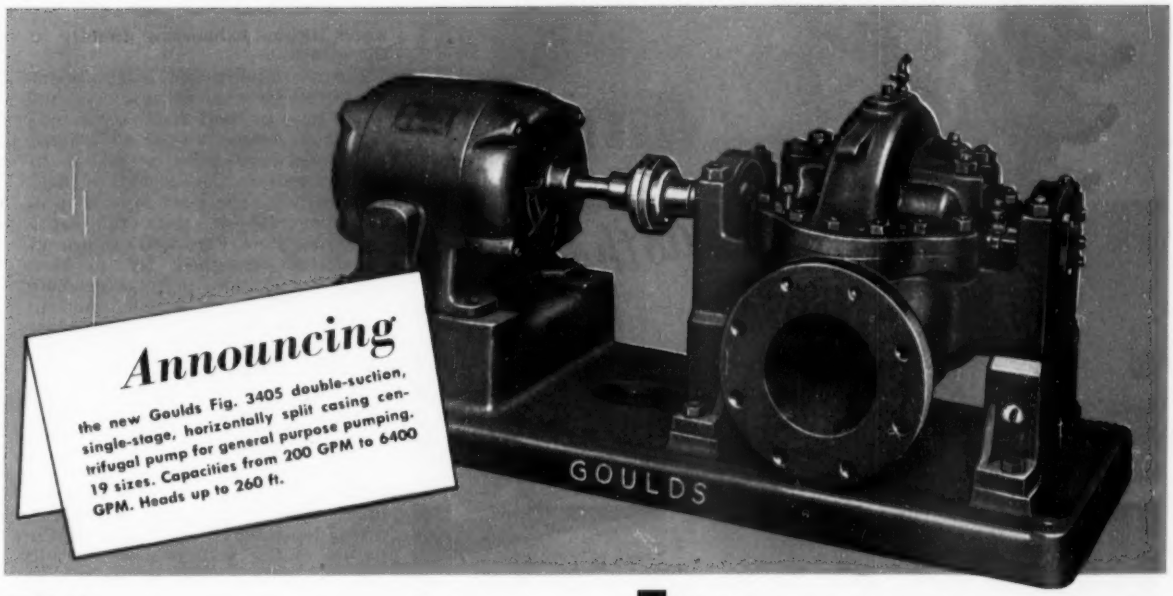
The above incident could only happen with vertical screens operating in fixed concrete screen chambers. Since the boom intake has no screen chamber, the fish cannot be trapped. Fish impinging on the screen are moved outwardly into the river, where they swim off or drop off when the screen has traveled beyond the suction area of the intake. Also, there is little danger of breaking baskets due to pressure differential because on the boom intake the screen normally travels on a flat incline with its own weight counteracting the upward pressure. Thus, in reverse of the present practice, the dirtier the screen, the less pressure on rollers and guides and the less the horsepower.

Cost of Installation

It is estimated that a complete installation of a boom intake, based upon the design shown in Fig. 1 and having a capacity of 100,000 gpm with a maximum water height of 80 ft, can be made at half the cost of a conventional installation. With reduction of the water height these savings are somewhat lower. But we believe it can be stated as a general corollary that the boom intake will greatly reduce total costs, maintenance costs, and at the same time provide cleaner water.

A unit with a screen of reduced length having a greater side area of housing, is more suitable for locations not subject to river current. Figure 2C shows a screening unit of greatly reduced length suitable for average low water conditions. Studies now in progress indicate that this latter unit, when equipped with a submersible drive, might well be adapted for all level conditions. The drive head, normally operating above water, would become completely submerged during floods. At such times cleaning of the screen is accomplished by underwater sprays of increased pressure, discharging debris directly into the river where flood turbulence carries it away. The submersible drive may consist of an underwater electric motor; or as an alternative, a

(*Continued on page 122*)


Announcing
the new Goulds Fig. 3405 double-suction, single-stage, horizontally split casing centrifugal pump for general purpose pumping. 19 sizes. Capacities from 200 GPM to 6400 GPM. Heads up to 260 ft.
GOULDS

This new pump gives you 5 big cost advantages

The price you pay is only one element of the cost of a pump installation.

Good engineering practice also figures in the cost of pump breakdowns, low operating efficiency, change-overs to meet new conditions, replacement parts inventories, even the floor space the installation takes up.

Here's why the new Goulds centrifugal pump is designed to improve your cost experience in every one of those elements.

1. *It combines seven design features that mean maximum operating efficiency and minimum maintenance.*

Every one of these construction features is standard with this new design. Together they offer you, without extra cost, a quality of service that's unique in its approach to general liquid handling.

a. Renewable stuffing box bushings.
b. Bearing housings sealed against moisture and dirt.
c. Cowl-type glands suitable for use with quenching liquids.
d. Stainless steel impeller keys.
e. Teflon water seal rings.
f. Die-formed stuffing box packing.
g. Corrosion resistant gland bolts.

2. *Interchangeability of parts.*

With only three shaft and rotating parts assemblies to provide for 19 pump sizes and 38 pump combinations, this new design offers you a remarkable range of interchangeable parts. A glance at the interchangeability chart on page 7 of the descriptive bulletin will show you:

a. how this design gives you great flexibility in making field changes should your pumping requirements change;
b. why the first cost of this unit is so low due to standardization in manufacture; and
c. how this interchangeability helps to reduce spare parts inventories.

3. *Compact construction.*

You will be particularly pleased with the short over-all length of this new design. Short bearing spans cut lengths as much as 50%. This means a real saving in floor space.

4. *Flexibility of stuffing box.*

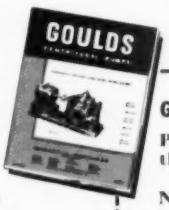
You can use either conventional stuffing boxes or mechanical seals depending on requirements. And you can change from one to the other in the field if need be.

5. *Easy rotation change.*

A unique device, locking shaft seals, permits you to change from right-hand rotation to left-hand rotation or vice versa in the field without construction changes.

More than 50 years of experience in meeting industry's needs for general purpose centrifugal pumps come to a climax in this design.

GET FULL DETAILS **This 12-page illustrated bulletin, No. 721.6, covers the complete details of the new Goulds Fig. 3405, including specifications, interchangeability tables and performance curves. Be sure you have the whole cost-advantage story before you select another general purpose pump. Contact your nearest Goulds representative or mail the coupon below today.**



GOULDS PUMPS, INC., Dept. PE, Seneca Falls, N.Y.

Please send me Bulletin No. 721.6 describing the new Fig. 3405 centrifugal pump.

Name_____

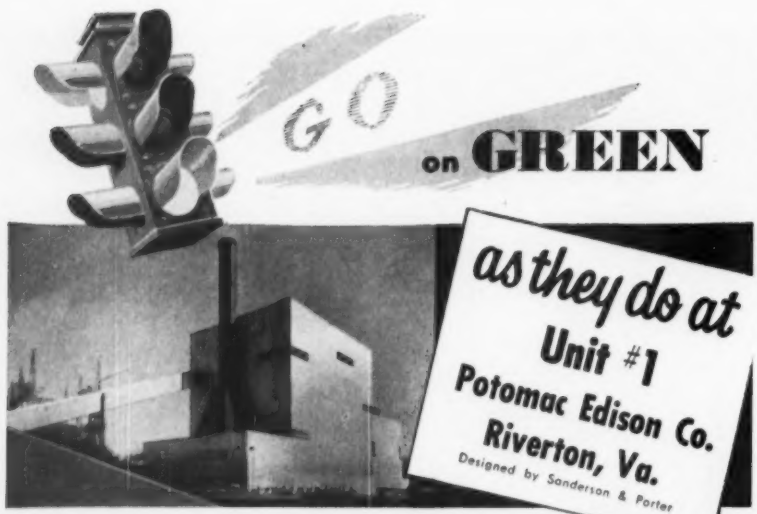
Company_____

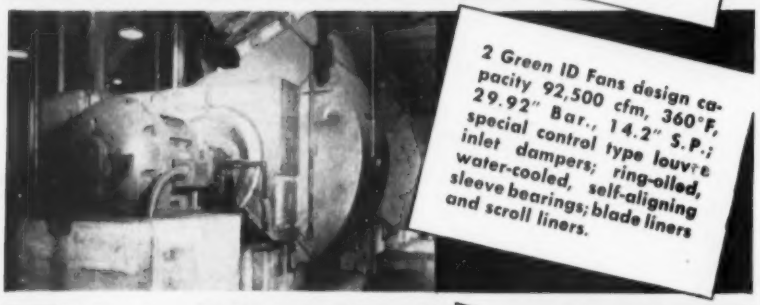
Address_____

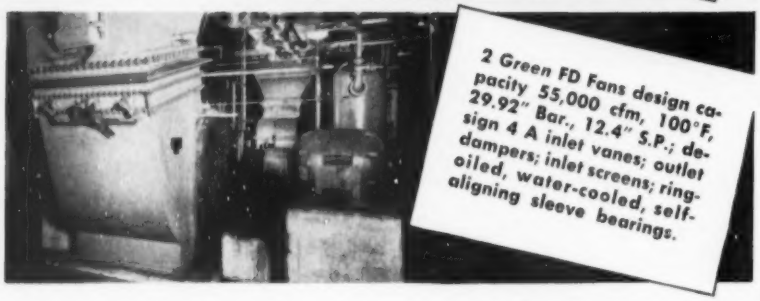
City_____ State_____

Goulds PUMPS INC.
Seneca Falls New York

For more data circle 563 on Post Card




2 Green ID Fans design capacity 92,500 cfm, 360°F, 29.92" Bar., 14.2" S.P.; special control type louvre inlet dampers; ring-oiled, water-cooled, self-aligning sleeve bearings; blade liners and scroll liners.


2 Green FD Fans design capacity 55,000 cfm, 100°F, 29.92" Bar., 12.4" S.P.; design 4 A inlet vanes; outlet dampers; inlet screens; ring-oiled, water-cooled, self-aligning sleeve bearings.

The list grows—the list of utility and industrial steam generating plants for which Green Fans were selected to provide the air necessary for combustion purposes.

Draft fans yield to no other equipment in their importance to efficient steaming. They must be properly designed for the requirements in each plant respectively. They must be conservatively rated. And they must be durably constructed.

Green Fans fulfill these basic requirements. You wouldn't find them in so many large utility plants and large industrial plants unless they had thoroughly proved their worth.

Our Catalog No. 168 tells all about Green Fans. Write for a copy.

THE GREEN Fuel Economizer COMPANY INC.

- Economizers
- Fans
- Air Heaters
- Cinder traps
- Aerodyne Dust Collectors

BEACON 3, NEW YORK

For more data circle 564 on Post Card

(*Continued from page 120*)

water turbine exhausting directly to the sprays.

Further applications of the boom intake include a detachable boot which may be used under some conditions to reduce cost of cofferdams and underwater work as well as to further reduce the period of field construction. The boot may be precast concrete or shop fabricated structural steel. Figure 2D shows an installation designed for a fixed operating position, preferably where there is little river level fluctuation. Entire assembly can be raised clear of the water for inspection and repairs. In this installation no boot is required. With the application of a submersible drive this type may also be used where flood conditions prevail.

Some hesitancy must be expected in acceptance of an innovation which performs a vital operating function upon which a considerable investment depends. But, because of the nature of the savings involved and the fact that cleaner water can be obtained, the boom type intake will present a challenge to engineers — especially in the face of constantly rising costs.

New Engineering Books Received

To be Reviewed in Detail Later

Electrical Engineering, Theory and Practice, by W. H. Erickson and N. H. Bryant; 523 pages; illustrated; size 6 by 9¼ in.; cloth binding. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N. Y. Price $6.00.

★ ★ ★

Proceedings of the National Electronics Conference — 1951 — Volume 7; 736 pages; illustrated; size 9¼ by 6¼ in.; cloth binding. Published by the National Electronics Conference, 852 East 83rd Street, Chicago 19, Ill. Price $5.00.

★ ★ ★

Transient Electric Currents, by Hugh Hildreth Skilling; 361 pages; illustrated; size 6¼ by 9¼ in.; cloth binding. Published by McGraw-Hill Book Company, Inc., 330 W. 42nd St., New York 36, N. Y. Price $6.00.

★ ★ ★

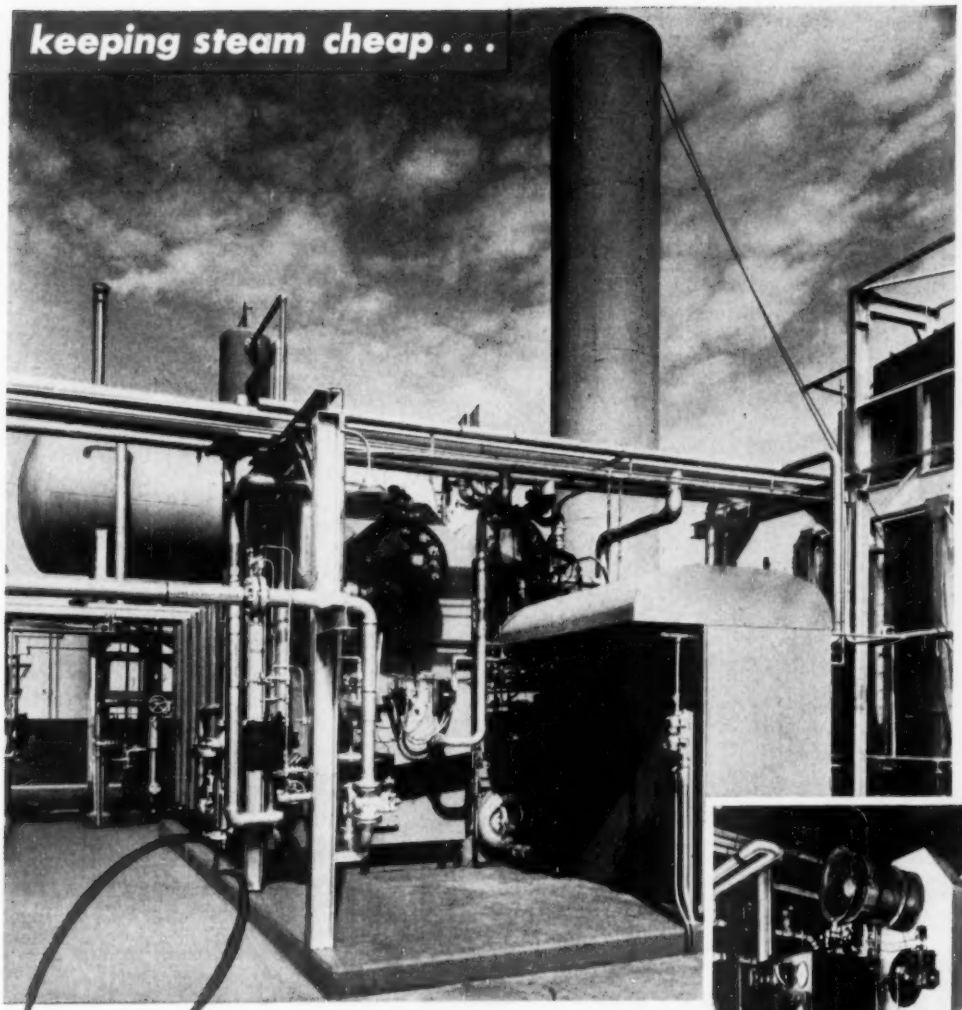
Elias E. Ries, Inventor, by Estelle H. Ries; 369 pages; size 5¾ by 8¾ in.; cloth binding. Published by the Philosophical Library, Inc., 15 E. 40th St., New York 16, N. Y. Price $4.75.

★ ★ ★

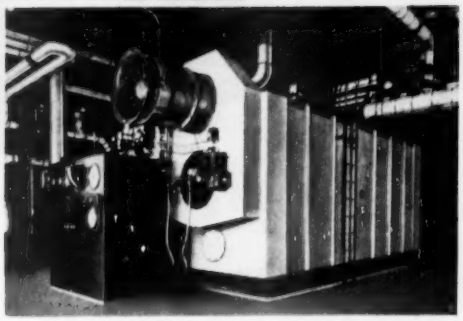
Harmonics, Sidebands and Transients in Communication Engineering, by C. Louis Cuccia; First Edition; 465 pages; illustrated; size 6¼ by 9¼ in.; cloth binding. Published by McGraw-Hill Book Company, Inc., 330 W. 42nd Street, New York 36, N. Y. Price $9.00.

(*Continued on page 124*)

keeping steam cheap . . .



Outdoor installation of shop-assembled B&W Integral-Furnace Boiler, Type FM at a large Texas refinery.



Conventional indoor installation uses a minimum of valuable space.

outdoors as well as indoors
SAVE with the
B&W Integral-Furnace Boiler, Type FM

Outdoor installation of the shop-assembled, *B&W Integral-Furnace Boiler, Type FM,* is an important cost-saving advantage that is gaining wide popularity with users in all sections of the country. A high percentage of units sold to date are for outdoor operation under year-round weather conditions.

A completely water-tight, rigid steel casing encloses the entire boiler and furnace of this compact B&W steam unit. Designed to permit proper expansion and contraction of the unit's various components resulting from seasonal temperature fluctuations, the casing is welded for additional strength and tightness. A blanket of mineral wool plus over-all high-temperature insulation of walls, floor, and roof, minimizes heat loss through radiation.

For installation outdoors or indoors, this versatile, self-contained B&W steam generator is available in steam capacities ranging from 2900 to 28,000 lb per hr, at pressures between 15 and 250 psi. Total steam capacity of units now in service and on order for over 50 different industries, utilities, and other users here and abroad exceeds 5½ million lb per hr.

OTHER COST-SAVING FEATURES

- Saves Erection Time and Cost
- Meets Wide Range of Service
- Handles Quick Load Changes
- Fast Steaming
- Low Maintenance
- Easy Accessibility
- Burns Oil and/or Gas
- Saves Fuel
- Saves Space
- Safe, Automatic Operation

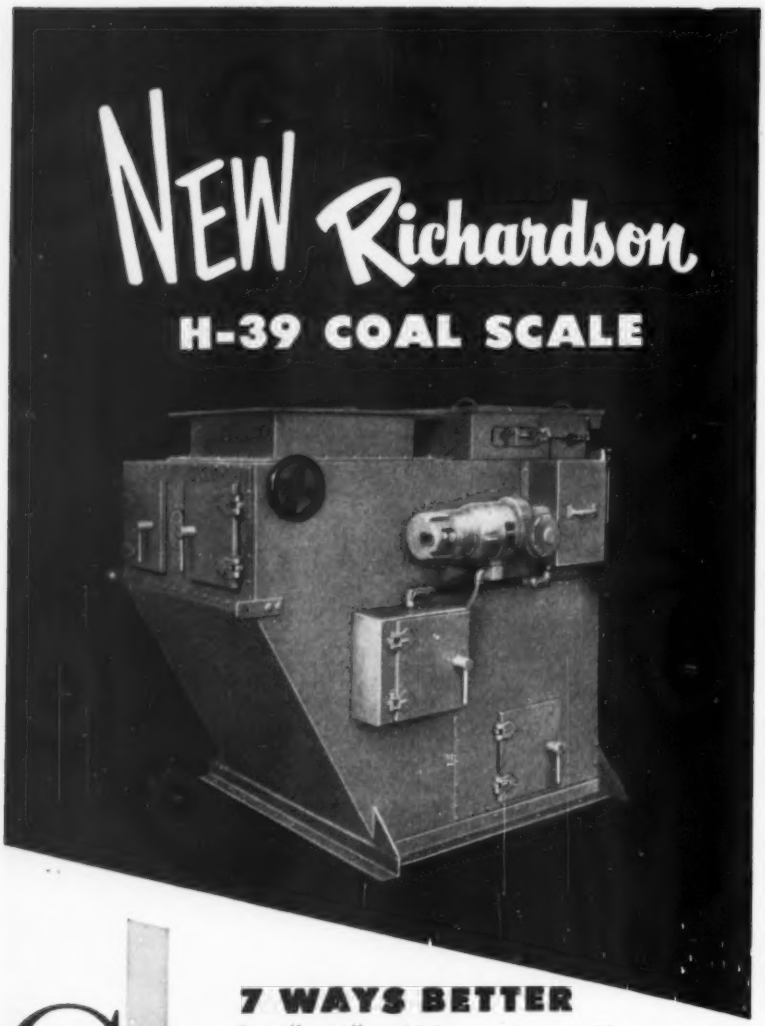
BABCOCK & WILCOX

Write for Bulletin G-76, for an illustrated, detailed description of the many other cost-saving features of this unique unit. The Babcock & Wilcox Company, Boiler Division, 161 E. 42nd St., New York 17, N. Y.

G-586

For more data circle 565 on Post Card

NEW Richardson
H-39 COAL SCALE



Compare...

7 WAYS BETTER

1. 24" x 24" coal inlet opening—50% greater area—for maximum flow-ability of coal.
2. *All* wiring and controls outside coal chamber.
3. Beam-ratio test facilities *completely outside* coal chamber.
4. Simple, gravity-operated bypass arrangement with no restriction in coal flow to downspout.
5. No drag-links or electrical wiring on weigh hopper.
6. Construction of access doors makes it *impossible* for coal dust to spill out on floor when opening.
7. Unequalled nationwide maintenance and service facilities.

That's why you just can't *buy better than a Richardson*

Get all the facts. Write for Bulletin 0352 today!

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Richardson

MATERIALS HANDLING BY WEIGHT SINCE 1902

8616

For more data circle 566 on Post Card

(Continued from page 122)

Electric Machinery, by A. E. Fitzgerald and Charles Kingsley, Jr.; First Edition; 701 pages; illustrated; size 6¼ by 9¼ in.; cloth binding. Published by McGraw-Hill Book Co., 330 W. 42nd St., New York 17, N. Y. Price $8.50.

★ ★ ★

Electrolytic Manganese and Its Alloys, by Reginald S. Dean; 257 pages; illustrated; size 6 x 9 in.; cloth binding. Published by The Ronald Press Company, 15 E. 26th St., New York 10, New York. Price $12.00.

★ ★ ★

New ENGINEERING BOOKS

BCR Fuel Cost Calculator; size 3½ by 9¼ in.; in form of slide rule; published and distributed by Bituminous Coal Research, Inc., 2509 First National Bank Building, Pittsburgh 22, Pa. Price 50 cents to non-members of the BCR association; 40 per cent discount to regular members.

This is a pocket size calculator designed for use by anyone having to do with fuel burning, but especially for those burning coal. This would include power engineers and personnel of coal burning plants, and, of course, coal company salesmen. It is designed to provide an easy method for making fuel cost comparisons and for computing coal consumption from boiler outputs.

On one side are scales giving equivalent values of steam in pounds per hour, boiler horsepower, Btu in millions per hour and equivaient direct radiation. There is a scale for coal burned at various efficiencies and various heating values.

On the other side are scales from which you can determine cost per million Btu in a fuel, cost at a particular efficiency and equivalent cost of other fuels, if used at same efficiency, and you can also perform other cost calculations.

Full instructions for using it are printed right on the calculator. The fuel price ranges on the slide are great enough so that the calculator will not become obsolete in the foreseeable future and the calculator takes into account efficiencies and all other pertinent factors. It should prove very useful in getting a quick comparison between coal and other fuels under various operating conditions.

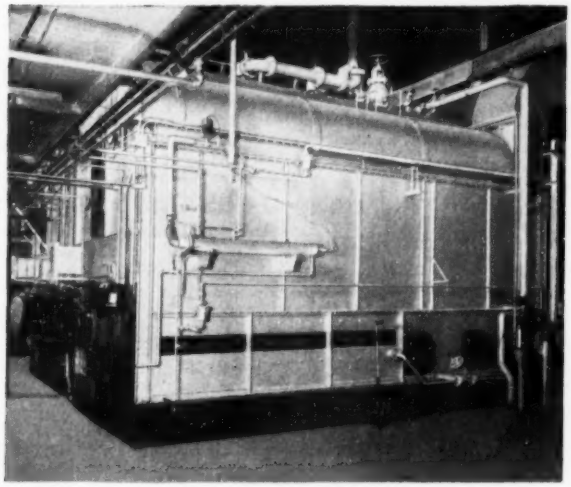
★ ★ ★

Piping Design and Engineering. First Edition; 221 pages; size 8½ by 11 in.; illustrated; cloth; published by the Grinnell Company, Inc., Providence, R. I.; 1951. Price $10.00.

The aim of this book has been to compile in a single publication such engineering data and technical information as engineers will need for the design and application of pres-

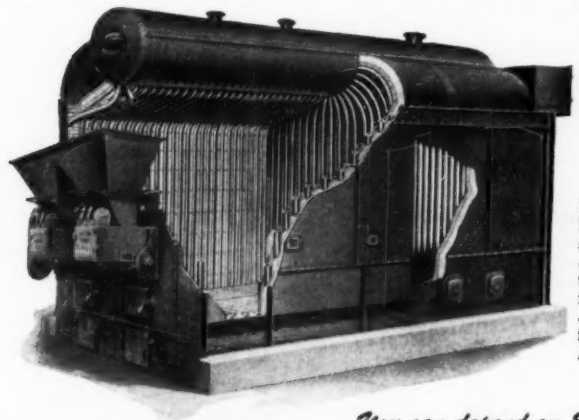
(Continued on page 127)

3 Erie City VL's Pay Off in 18 Months at Kaiser-Frazer



Above: Battery of 3 Erie City "VL's"—oil and gas fired—that replaced 7 obsolete coal fired units at a Detroit plant of Kaiser-Frazer Corporation.

Below: Sectional view of standard factory-assembled Erie City "VL" boiler with Erie City spreader stoker. Available for all firing methods.



Before modernization of the E. Jefferson Avenue Detroit plant of Kaiser-Frazer, seven coal fired boilers dating from 1911 and 1920 were in service. The new power plant consists of 3—20,000 pounds per hour Erie City "VL's" for oil and gas firing. They supply steam for heating and process.

While the cost of steam, using coal, would be about 5 cents less per thousand pounds, the use of oil and gas reduced capital investment due to the elimination of new coal storage and allied equipment. Average boiler efficiency of the 3 new Erie City "VL" boilers is 81.5%. Power house labor was reduced from 14 to 6 men. The combined savings from greater efficiency, minimum maintenance and reduced labor costs is expected to pay for the new boiler installation in 18 months.

Are you wasting fuel dollars with worn out boilers? Let Erie City Engineers recommend steam generators that will pay for themselves out of savings.

20 Page Catalog describing Erie City "VL's" in detail shows its easy adaptability to all firing methods and illustrates its superior design features. "VL's" are factory assembled to 300 hp. and field erected in larger sizes. Ask for Bulletin SB-43.

You can depend on Erie City for sound engineering

ERIE CITY 113 Years In Steam Generation

ERIE CITY IRON WORKS • Erie, Pa.

STEAM GENERATORS • SUPERHEATERS • ECONOMIZERS • AIR PREHEATERS

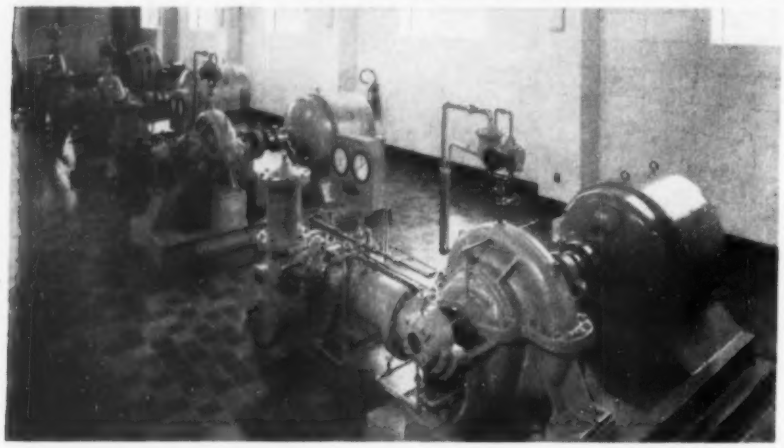
UNDERFEED AND SPREADER STOKERS • PULVERIZERS

For more data circle 567 on Post Card

WORTHINGTON

POINTERS ON PUMPS

Prepared for Industry by Worthington Pump and Machinery Corporation



A Plan That Gets the Most out of Centrifugal Pumps

Easy-To-Install Maintenance Program Means Better Performance, Longer Life

You can't get maximum production when your equipment's operation is constantly interrupted due to breakdowns. Moreover, today's equipment shortages make it increasingly more important that you get all the life you can out of your present machines.

We'd like to suggest a maintenance plan that will help you get the most out of one of your most vital pieces of equipment—centrifugal pumps.

Keep Informative Records

If you haven't already done so, it's a good idea to begin your maintenance plan by setting up a card index file so that you can catalogue each pump in your plant. Each card should contain the following information: plant pump number, size, manufacturer's name and style, serial number, date installed, and any other data which will help you to rapidly locate repair parts lists and manufacturer's parts numbers.

The rest of the card can be divided into a number of columns: Repair Date, Part Affected, Remarks, and Cost. A typical card is shown here.

PUMP MAINTENANCE CARD

_____ PUMP NO. _____ MANUFACTURER
_____ SIZE _____ MFGR'S ADDRESS
_____ DATE INSTALLED _____ MFGR'S SERIAL NO.
_____ LOCATION _____ MFGR'S STYLE

DATE	PART	REMARKS	COST

If you're careful to enter every maintenance or repair operation on the proper card, it won't be long before each card indicates a particular pattern of maintenance.

Set Up A Maintenance Schedule

Once this pattern is established for all the cards, you can set up a schedule of maintenance points for such items as: packing, greasing or oiling, painting, gasket replacement, and bearing examination. You may find, for example, that a unit or group requires packing maintenance about once every three months, and greasing once every four to six months, etc.

Your next step is to arrange a plant schedule so that a particular pump may be shut down for maintenance at or before these times. Thus you make it possible to do the maintenance work under proper and unhurried conditions to assure maximum conformity of production consistent with long pump life. In addition, examination of the card catalogue will guide operating and maintenance personnel as to quantity of repair parts they should keep on hand.

Make Periodic Inspections Externally

It is considered *inadvisable* to open pumps for inspection.

Rather, recent practice is to let pumps stay on the line until such time as external symptoms indicate overhaul may be required. These symptoms involve either a reduction in effective capacity because of wear at the internal clearance points or mechanical difficulties, such as vibration or noisy operation.

Parts requiring most frequent replacement in centrifugal pumps are: wearing rings, shaft sleeves, packing and bearings.

The most important maintenance point on process pumping equipment is the stuffing box. It must be kept clean, cool, and lubricated—but *packing* is the crucial operation. A good packing method will be discussed in a later edition of *Pointers on Pumps*.

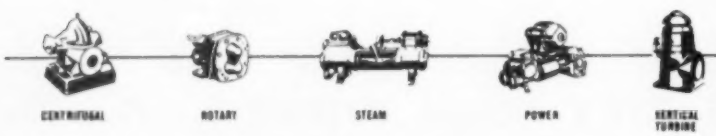
Don't forget the frames, base plates, and supporting parts of your pumps. Good housekeeping often makes it easier to do a good overall maintenance job!

Can We Help You?

Worthington makes more *standard* pumps than any other manufacturer. Don't buy a "special" (at a higher price) without checking to see if Worthington makes it *standard*.

If you *do* need a special, remember Worthington's modern engineering facilities, backed by the longest and broadest experience in the field. Contact our nearest District Office or write to Worthington Corporation, Centrifugal Pump Division, Harrison, N. J.

C.2.2



The World's Broadest Line Assures You the Right Pump for Every Job

WORTHINGTON
Centrifugal Pumps

For more data circle 568 on Post Card

NEW BOOKS

(Continued from page 124)

sure piping systems. Much of this information has hitherto been available only by consulting various books and articles. To this information the authors have added considerable material never previously published.

The book begins with a discussion of expansion and stresses and goes on to cover velocity and pressure drop calculations, then discusses heat transfer. A number of pressure-temperature pipe graphs are given, then a detailed discussion of piping materials. This is followed by complete coverage of pipe fabrication, then data tables and all necessary information on pipe hangers and supports. The book concludes with general engineering tables and there is a good bibliography of books and articles for reference.

The book is filled with tables, charts and numerical calculations, leading to practical answers and it seems to us that the objective has been well attained. This book should be of the most practical value to anybody having to do with design of practical piping systems.

★ ★ ★

Heating Design and Practice, by Robert Henderson Emerick. First Edition; 453 pages; size 6 by 9 in.; illustrated; cloth; published by The McGraw-Hill Book Company, 330 W. 42nd St., New York 18, N. Y.; 1951. Price $8.00.

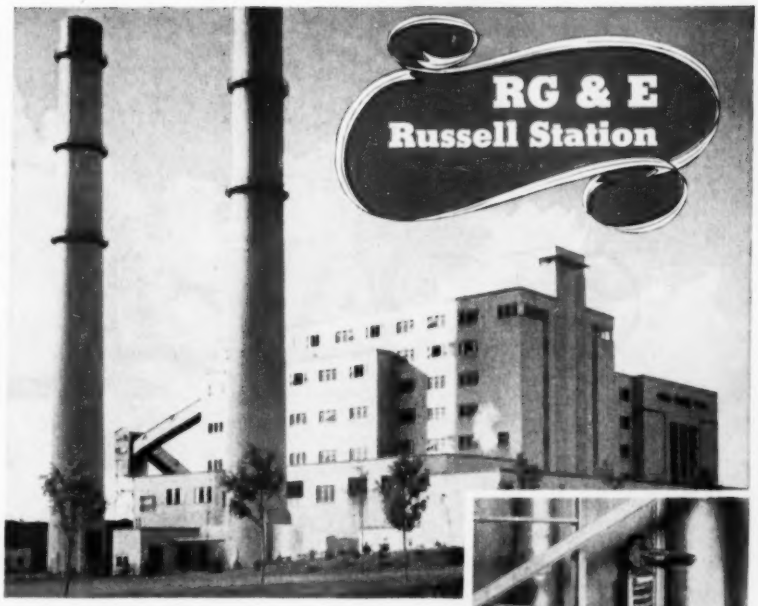
Some time ago, the author, a consulting mechanical engineer, brought out a book on Basic Refrigeration and Air Conditioning. That book was an outgrowth of an experience he had during World War II, when he had the job of training a large force of men of various trades — pipefitters, machinists and so on — who had to install and repair refrigeration and air cooling machinery at one of the big Navy Yards.

He had to approach the subject so as to make the theories and principles of refrigeration and air conditioning understandable, regardless of the readers' formal education. He worked out a method of doing so by first explaining basic principles and immediately following those with a practical, numerical example applying the principles with specific numerical answers to be reached. In the present book, he has followed much the same style and with similar good results.

He first explains how heating loads are calculated and how to design a steam heating system, then does the same for hot water heating and water heaters, also for warm air heating systems. He covers fans and filters, space heaters, the heat pump, combustion, chimneys, stack and flues, and how to choose a heating system; and the last chapter is a very practical one on specifications and the analysis of bids.

In our opinion, this is a very practical and helpful book based on a good deal of experience in designing and specifying exactly this kind of equipment.

(Continued on page 128)



Safety Valve Report:

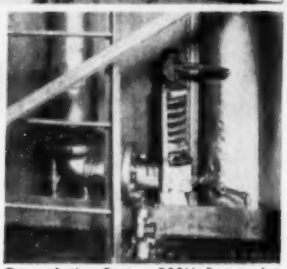
- **"2 YEARS IN SERVICE...**
- **NO MAINTENANCE...**
- **STILL TIGHT!"**

That's the report from Rochester Gas & Electric Co. on the Foster Super Jet Safety Valves on the #2 unit of their new Russell Station.

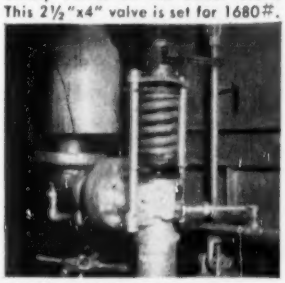
Other points they like about these valves are their greater capacity, so that fewer valves are necessary, and their accessibility for inspection and service.

Foster Super Jet Safety Valves give better protection two ways: absolute protection against overpressure, and greater protection against costly outages caused by service failures.

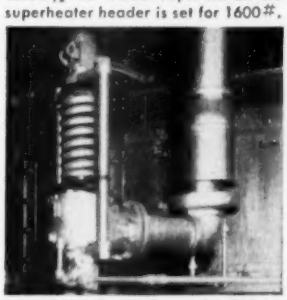
For full information on Foster Super Jet Safety Valves, ask for Bulletin 80-SV.



One of the Foster 38SV Super Jet Safety Valves on the boiler drum. This 2½"x4" valve is set for 1680#.



This 2½"x4" Foster Super Jet on the superheater header is set for 1600#.



One of the Foster Super Jet Safety Valves on the reheater inlet header. This 4"x6" valve is set for 530#.

FOSTER ENGINEERING COMPANY · ESTABLISHED 1918 · FOSTER AUTOMATIC VALVES

PRESSURE REGULATORS • RELIEF AND BACK PRESSURE VALVES • CUSHION CHECK VALVES • FAN ENGINE REGULATORS • PUMP GOVERNORS • TEMPERATURE REGULATORS • FLOAT AND LEVER BALANCED VALVES • NON-RETURN VALVES • VACUUM REGULATORS OR BREAKERS • STRAINERS • SIRENS • SAFETY VALVES • FLOW TUBES

FOSTER ENGINEERING COMPANY · UNION, N. J.

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Steam

plus

CORAVOL

(The Original* AMINE PROCESS) ®

equals

Protection (FROM CORROSION)

Because CORAVOL Circulates to Control Corrosion

CORAVOL circulating throughout your steam system protects it from corrosive attack. **CORAVOL** saves costly pipe repairs and replacements—maintenance labor—hours and days of shutdown loss. **CORAVOL** cleans out clogging rust deposits, improving heat transfer, restoring original capacity of lines and efficiency of valves and traps.

CORAVOL, the original* amine process, has the flexibility that lets it conform to each individual need. The **CORAVOL** *you* will use is formulated to do the best protective job under your own plant conditions.

CORAVOL IS PART OF A COMPLETE TECHNICAL SERVICE which provides special chemical formulas for: boiler feed water . . . foam prevention . . . hot water supply . . . refrigerating brine . . . cooling and condenser water . . . rapid scale removal . . . coagulation . . . algae control . . . fuel oil supply . . . soot removal.

*The use of **CORAVOL** in steam systems is covered by U. S. Patent No. 2053024. The Western Chemical Co., owner of this patent, grants licenses under which volatile AMINES purchased from other sources may be used in steam systems upon payment of royalty to Western Chemical Co.

Chemical Water Treatment

WESTERN CHEMICAL COMPANY

717 Washington Street
Kansas City 6, Missouri

MAIL COUPON TODAY for
Complete Data about the CORAVOL Process

Western Chemical Company,
717 Washington Street,
Kansas City 6, Missouri
Send me full information about CORAVOL.

NAME _____

FIRM _____

ADDRESS _____

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STATE _____

For more data circle 570 on Post Card

NEW BOOKS

(*Continued from page 127*)

Gas Transmission and Distribution Piping Systems (ASA B31.1.8–1952) (Section 8 of American Standard Code for Pressure Piping); illustrated; 36 pages; size 8 by 11 in.; paper bound; published by The American Society of Mechanical Engineers, 29 West 39th Street, New York 18, N. Y.; price $1.25.

This code for pressure piping is one of a series of safety codes on various subjects which have been, or are being, formulated under the general auspices of the American Standards Association, and represents a standard of minimum safety requirements for: (1) the selection of suitable materials and reference to standard specifications by which they may be secured; (2) the designation of proper dimensional standards for the elements comprising piping systems; (3) the design of the component parts as well as the assembled unit including necessary supports; (4) the erection of these systems; and (5) the test of the elements before erection and of the completed systems after erection. It is intended to set minimum safety requirements expressed in language which is intelligible to all who design, manufacture, and erect piping systems, but not necessarily to cover the best practice known to the art. While in most cases the requirements are mandatory, design recommendations have been included where they will be of assistance in securing safe piping systems.

LETTERS TO EDITORS

(*Continued from page 83*)

thermocouples. This approach corresponds to a steam power plant net turbine heat rate wherein the auxiliary power has been deducted from the gross power generated, but the boiler has been taken as 100 per cent efficient.

Now the thermodynamic efficiency of the thermocouple power cycle can be expressed quite simply as:

$$\text{Efficiency} = \frac{A - B}{C \quad D} \qquad \ldots\ldots\ldots(1)$$

A = total electric energy internally produced by the thermocouples

B = electric energy dissipated as I^2R losses within the thermopile due to the resistance of thermocouple material and the contact resistance at the connecting strips

C = Peltier heat input, or that quantity of heat supplied to the cycle which is actually utilized with Carnot-like efficiency to produce electric energy and to supply some heat rejected at the cold junction

D = ordinary conduction of heat which occurs when hot rods each have one end poked into a furnace and the other end projecting into the room.

Our actual quantities on test were:

$$\text{Efficiency} = \frac{0.01619 \text{ watts} -}{0.03137 \text{ watts} +}$$

(*Continued on page 130*)

Powell Engineers always look to the future!

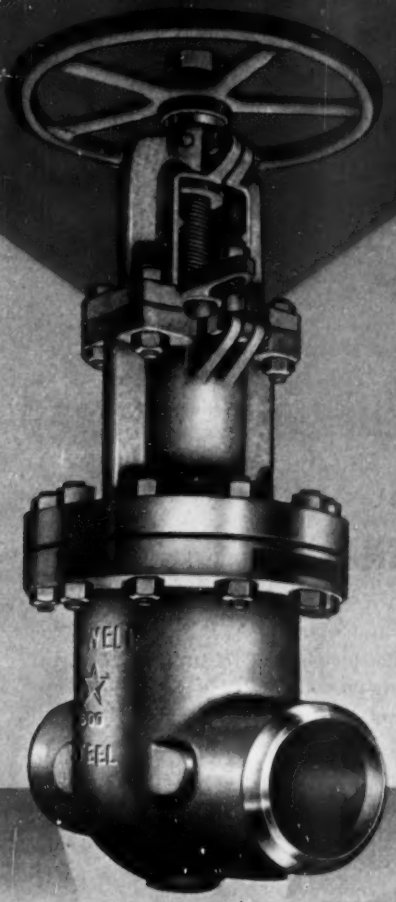

Fig. 3003 W. E. 300-pound, Cast Steel, O. S. & Y. Gate Valve with welding ends.

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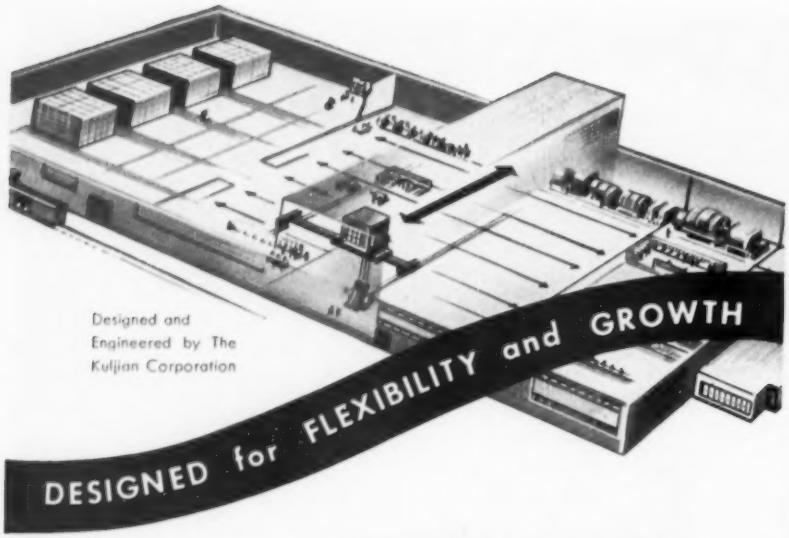

GENERAL ELECTRIC SERVICE SHOP AND WAREHOUSE

The new General Electric Service Shop and Warehouse in Philadelphia is a striking example of a building properly designed to permit flexibility of operation and future growth.

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LETTERS TO EDITORS

(Continued from page 128)

$$\frac{0.01428 \text{ watts}}{1.054 \text{ watts}} = 0.00018 \text{ per cent}$$

This extraordinarily low level of efficiency makes us re-examine equation (1) again to see what is happening. The A and C terms are satisfactory, and are in accordance with the performance of a reversible cycle between fixed temperature limits.

Of the B term, internal electrical resistance, approximately 20 per cent is due to resistance in the thermocouple material and fully 80 per cent is located in the contact resistance of the connections. Thus, perfect connectors would produce a seven-fold increase in the value of the numerator, A-B.

In place of each thermocouple in a series circuit we can substitute a multiple packet of thermocouples in parallel, thereby increasing the conductor cross-sectional area, and decreasing the B term still more.

The above steps are all shadowboxing compared to the real problem found in term D. The conducted heat is enormous, and little can be done about it with our present design of one shell of thermocouples in a furnace. If we seek to change the thermocouple materials, we encounter the dilemma that substances that are poor thermal conductors are also poor electrical conductors. Also, the attempt at increasing the cross-sectional area of the thermocouples to decrease electric resistance would at the same time lead to increased conducted heat flow.

Two roads lead to a solution. If we make the numerator large by generating more power with the same temperature differential, then the relative importance of the conducted heat term decreases. We can generate more power if we can discover thermocouple materials that have greater rates of voltage production per degree temperature differential. Thus on one road we can seek out new materials possessing high voltage generation and low electrical resistance.

The other avenue leads to the employment of concentric thermocouple shells. This arrangement, in which the heat rejected by one shell is the heat input to the next, was mentioned in Mr. Bassett's earlier articles. The more numerous the shells, the longer is the path confronting the undesired heat transfer process. Thus, we try to make the denominator smaller to increase the efficiency.

In the light of the thesis results, there appears to be a long, long way to go before the bugaboo of conducted heat transfer can be handled.

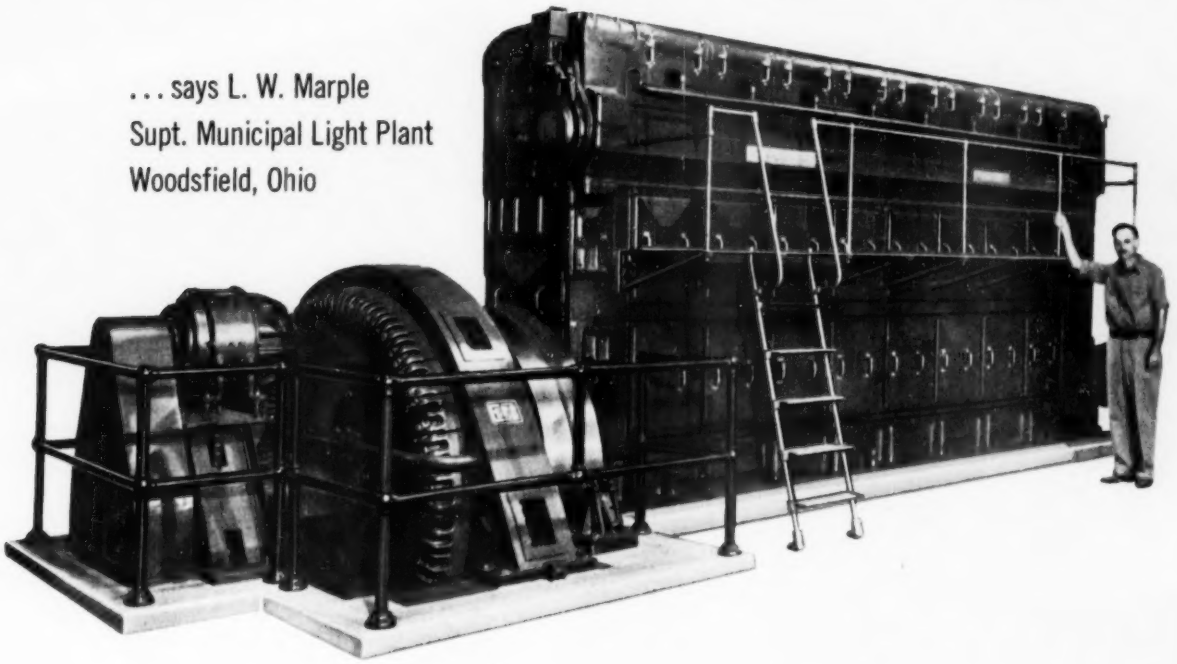
Brooklyn, N. Y. — Jerome Bartels, Erwin Thater

Editor's Note: — Mr. Bartels is assistant professor of mechanical engineering, Polytechnic Institute of Brooklyn

(Continued on page 133)

"No More Sticking Rings"...

... says L. W. Marple
Supt. Municipal Light Plant
Woodsfield, Ohio



● "Because of the lubricating oil we were previously using," says Mr. Marple, "sticking rings and carbon build-up were persistent problems on our three Fairbanks-Morse Model 32-E diesels.

"Three years ago, at the recommendation of one of your lubrication engineers, we switched to Sinclair GASCON® Oil D – HD.

"GASCON D – HD has cleared up our troubles... no more sticking or broken rings... no more carbon build-up, even though our load factor has increased. The result is a considerable savings in maintenance costs.

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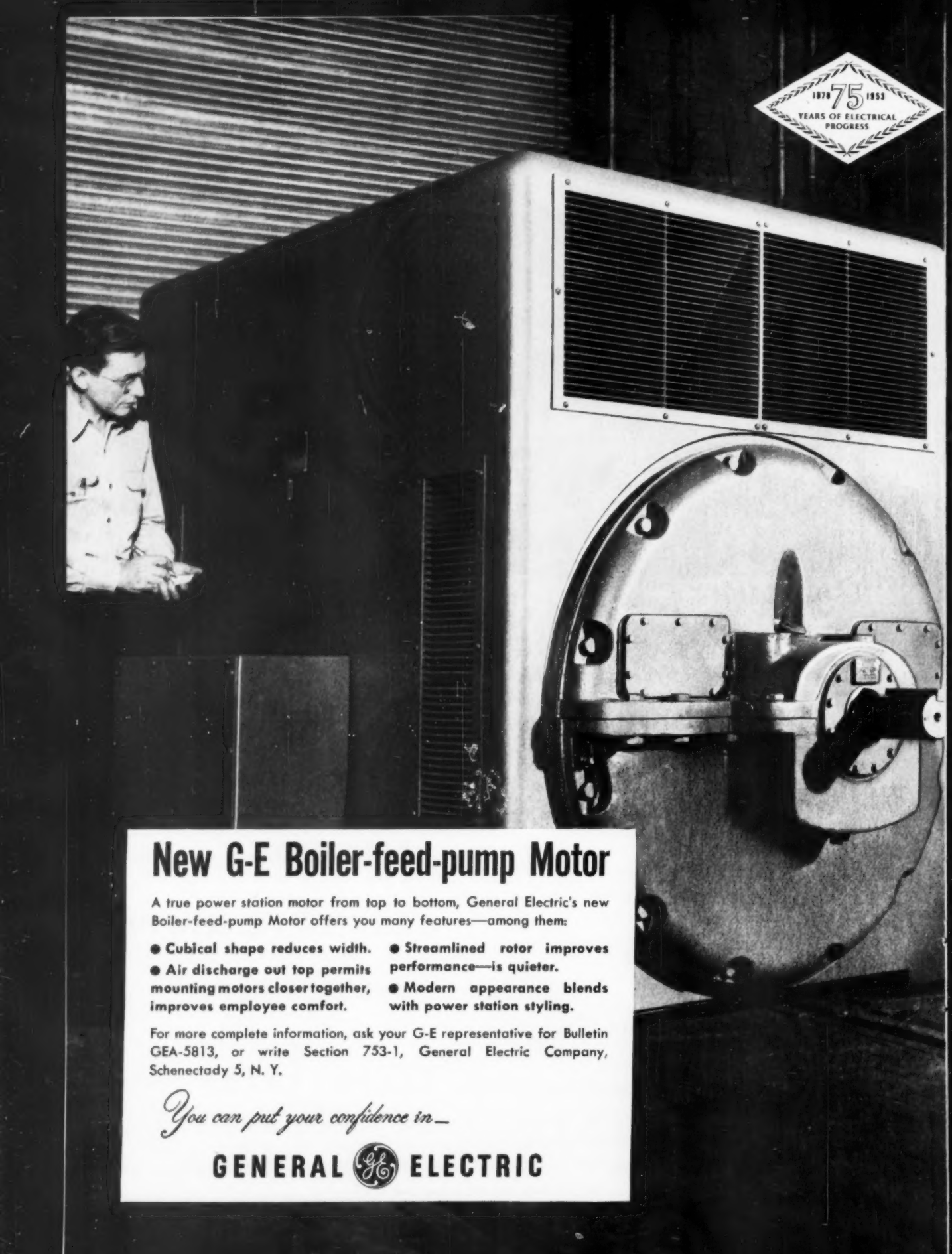

New G-E Boiler-feed-pump Motor

A true power station motor from top to bottom, General Electric's new Boiler-feed-pump Motor offers you many features—among them:

- **Cubical shape reduces width.**
- **Air discharge out top permits mounting motors closer together, improves employee comfort.**
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For more complete information, ask your G-E representative for Bulletin GEA-5813, or write Section 753-1, General Electric Company, Schenectady 5, N. Y.

You can put your confidence in—

GENERAL ELECTRIC

(Continued from page 130)

and Mr. Thater is project engineer, Brooklyn Refinery, Socony-Vacuum Oil Co. Their letter is presented here because (a) it reflects the continuing interest in the ideas presented by C. D. Bassett in 1949 and 1950, as evidenced by our correspondence with readers since that time; (b) it presents the results of an actual test of those ideas, showing the influence of the conducted heat transfer, which we have already noted; (c) it is only one of several cases, recently reported, in which attempts are being made to turn heat energy directly into electricity.

One of these, for example, is the recent work of Pittsburgh Consolidation Coal Co. in a patented process that claims conversion of carbon to electricity at an over-all efficiency of about 60 per cent. Producer gas and air are fed to a reaction chamber containing anodes and cathodes separated by a high-melting glass solid electrolyte. By various methods, a temperature of 1850 F is maintained in the chamber, and the resulting reactions generate electricity. Coal or other hydrocarbons, such as methane, may be used in the reaction.

Another device, used for measuring gamma radiation, is claimed to convert the radioactive energy directly into electrical energy. The same manufacturer, using this principle, is designing an "atomic battery" employing a radioactive material with a 25-year half life. This battery would have a voltage of 1 to 1.5 v and deliver 10 microamperes of current. It would presumably have some applications in instruments.

Philadelphia Engineers Form New Hydraulics Organization

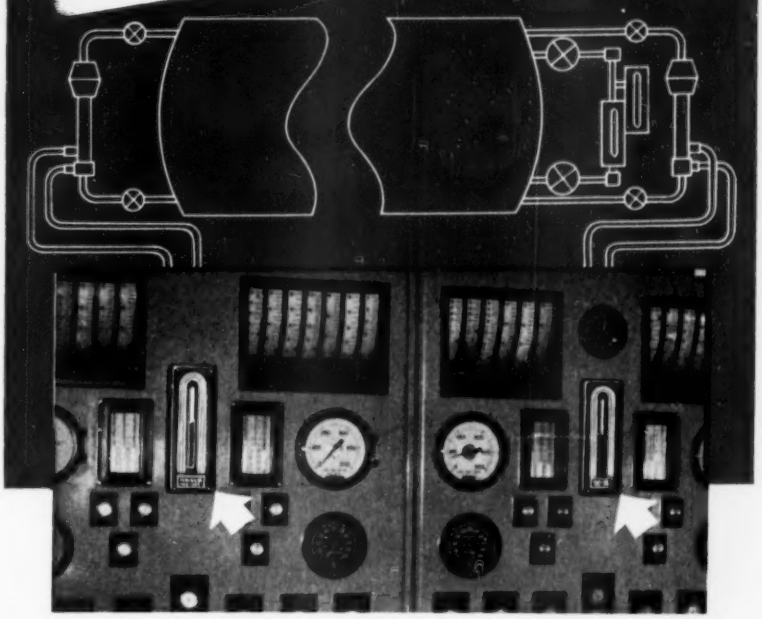
FOLLOWING the meeting of the National Conference on Industrial Hydraulics in Chicago last Summer, a group of Philadelphia engineers became interested in forming a similar group in the Philadelphia area. At the invitation of the American Engineering Co., 122 people met at a dinner on October 27 to discuss it.

As a result of a secret ballot taken during the meeting, it was decided to affiliate with the ASME and enlist the co-operation of the ASCE.

An organization committee was formed, with J. S. Bennett, vice president of the American Engineering Co., as Chairman. This committee met on November 19, and agreed that the term "Fluid Power Systems" be used to describe the activities of the group. The committee arranged for two meetings in Philadelphia: February 18 and April 8, 1953.

All persons interested in the subject are invited to attend these meetings. There is no obligation to hold membership in any engineering society. If interested, contact J. S. Bennett, vice president, American Engineering Co., Philadelphia.

Latest boiler code provision permits new water gage facility on high pressure boilers



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For full details of the new code interpretation read Case No. 1155. For information about Reliance EYE-HYE, call your Reliance representative or write for Bulletin CO.

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Wilson Accessories — Various boilermaker accessories are in stock such as right angle worm drives, gear trains, extensions, universal joints in standard size squares, etc. Look to Wilson for a complete line of modern expander tools.

Wilson Tube Cleaners make short work of the toughest deposits. Driven by air, water, steam or electricity, these high speed tube cleaners can be furnished in straight or curved, ferrous or non-ferrous from 3/8" to largest ever cleaned. Write for Bulletin 47A.

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HELPFUL BULLETINS

(*Continued from page 88*)

130 Hand Pumps — Six-pp Bulletin HP206 describes and pictures pumps of 7 to 28 gpm capacity for pumping lube oils, thinners, solvents, cutting oils and industrial liquids from drums, wheel tanks or underground storage. Also shows models used as refueling systems for power equipment, as well as mounting accessories. Blackmer Pump Co.

131 Rotary Pumps — Eight-pp Catalog 952 offers application and ordering information on rotary pumps for pressures to 1000 psi. Fully illustrated, includes photos and dimensional drawings along with construction details. Explains design principle involving only two moving parts, operational advantages. Geo. D. Roper Corp.

132 Centrifugal Compressors — Twelve-pp Bulletin 109 describes and pictures single-stage centrifugal compressors for delivering large capacities of pulsation-free air or gases. Their functions, applications, ratings, construction features, arrangements and methods of control are presented. American Blower Corp.

133 Improved Compressor — How this manufacturer's Spiraxial compressor for air or gas is designed to provide peak efficiencies with minimum servicing is explained in Bulletin SC-152. Construction and design details are discussed in detail. Roots-Connersville Blower.

REFRACTORIES

134 Refractory Cements — Sixteen-pp Form 863, presenting a line of refractory cements, discusses the three basic materials used in them, provides a detailed selection guide and illustrated discussion on methods of preparation and installation. Also defines terminology. Norton Co.

135 Boiler Refractory — Company's Thintite tile for water wall backing and boiler baffles is described in 8-pp Bulletin 44. Illustrates various wall constructions utilizing Thintite, and includes typical sectional elevations, drawings of suggested tie-backs. Also gives physical characteristics of castables. Laclede-Christy Co.

OTHER EQUIPMENT

136 Tools for All Jobs — Seventy-pp Catalog 301 is the new edition of manufacturer's ordering book for a broad line of tools. Presents clamps, lathe dogs, tool holders, pipe tongs and vises, many types of wrenches and other tools. Tools are pictured along with sizes, weights and brief text on where to use them to advantage. Includes handy comparison chart showing new and old American standard square and hexagon bolts and nuts as related to nominal wrench openings. J. H. Williams & Co.

137 Improved Grommet V-Belt — The Texrope, a grommet V-belt engineered for longer service, cooler running, less slip and stretch, is described in Bulletin 20B6497A. Cross section drawings show how this belt provides higher gripping pressure under all load conditions; text describes its no-splice construction. Allis-Chalmers Manufacturing Co.

138 Molybdenum Disulfied Lubricants — Bulletin 95, 8 pp, gives technical information on standard industrial grades and compositions of Molykote lubricants, including prices and packaging data. Features a detailed description of this new principle in lubrication and applications of the compound. Describes a dry powder lubricant; a grease consistency mixture; a bonded coating; colloidal dispersion, and liquid dispersion. The Alpha Corp.

139 Spray Nozzles — Twenty-pp Bulletin 6-A contains complete technical details on atomizing and spray nozzles. Detailed information, given separately for atomizing nozzles, spray nozzles and spray nozzle clusters, includes construction details, spray characteristics and capacities. Dimension tables, capacity charts are included. Schutte and Koerting Co.

140 Induced Draft Fans — Manufacturer's induced draft Bifucator fans, said to provide controlled draft for boilers and furnaces at all times, are the subject of 8-pp Bulletin DB-32-52. Illustrations, specifications and dimensions of these fans in 24 sizes for both high pressure and low pressure boilers included. DeBothezat Fans Div., American Machine and Metals, Inc.

141 Engineering Data for Heating Systems — A great deal of helpful information on heating systems is presented in Engineering Data Manual 2095, 28 pp. Detailed, illustrated information pertaining to heating problems is given. Besides covering heating terminology, there are sections on steam data, water properties, piping data, weights and measures, and pipe and fitting dimensions. Also included is a chapter giving conversion formulas, other information. C. A. Dunham Co.

142 Air Hose — Catalog section 3460 describes five grades of air hose with tough, oilproof covers to prevent peeling. Specifications are listed and materials and methods used in construction are described along with recommended uses for the various types. The B. F. Goodrich Co.

143 Packaged Deaerating Heater — A new spray-type deaerating heater for smaller boiler plants is described in Bulletin WC-110. This compact heater is equipped with all accessories including overflow level control, thermometers, relief and vent valves. Bulletin shows how heater is built, how it works; tells what it's designed to do, and gives features. Includes sizes, capacities and dimensions. Graver Water Conditioning Co.

144 Industrial Incinerators — This bulletin describes and pictures incinerators for industrial and commercial use. Gives information on their installation and operation, as well as on automatic controls and special equipment. Winnen Incinerator Co.

145 Tape Use Manual — Now available to qualified power engineers is this manufacturer's standard industrial classification manual, approximately 80 pp. Contains 21 major group classifications, 175 detailed industry classifications and some 1500 specific uses for industrial tape. It constitutes a basic guide to tape usage and additions are planned to keep it up to date. Polyken Industrial Tape Dept., Bauer & Black.

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BOILERS, GENERATORS

201 Shop-Assembled Boiler — Sixteen-pp Bulletin G-76, completely describes and illustrates company's Type FM water-tube integral-furnace boiler, made in standard sizes from 2900 to 28,000 lb of steam per hr, pressure to 250 psi. Savings in erection, installation and moving costs are stressed along with wide range of applications. Capacities, dimensions and weights are given along with efficiency data. The Babcock & Wilcox Co.

202 Re-circulation Steam Generator — Here's a 6-pp folder on a controlled re-circulation steam generator, describing its development and uses, such as applications where steam is required in remote locations, where demands are intermittent, or load fluctuating. Combustion Engineering-Superheater, Inc.

203 Steam Generators — Twenty-pp Bulletin SB43, 20 pp, describes company's VL factory assembled generators combining 2-drum water-tube boiler, integral water cooled furnace, brick work, insulation and steel casing. A large cutaway illustration shows design details, and gas travel. Use of generator with various fuels and firing arrangements is covered. Erie City Iron Works.

204 Steam Boilers — Form SG 128-749 is a 12 pp catalog illustrated with photos of steam boilers for processing and heating, ranging from 15 to 500 hp and 15 to 200 psi. Includes diagrammatic cross-section of four-pass design characteristic of manufacturer's boilers. Cleaver-Brooks Co.

TUBING AND ACCESSORIES

205 Condenser Tubes — Excellent factual information on condenser tubes and their service life is given in this 40-pp illustrated booklet. Subjects discussed include corrosion of condenser and heat exchanger tubes, corrosion resistance and control, the selection of tube materials, and the composition and physical properties of company's alloys. Details on proper tube installation are presented, as are specifications, conversion tables, weights of tubes and alloys, formulas, terminology. Scovill Mfg. Co.

206 Life Extension for Condenser Tubes — This 32-pp extensively illustrated booklet reports on research into the causes of corrosion and means of combating them, as well as the choice of condenser tube materials. Points out that Admiralty metal, long a standard for power plant condenser tubes, works satisfactorily in most installations, but other alloys may be necessary in some circumstances. Revere Copper and Brass, Inc.

207 Nickel Pipe and Tubes — Bulletin T-17 is a 27-pp technical bulletin on the fabrication and design of nickel and high nickel alloy pipe and tubing, illustrated throughout by drawings and photos. Presents tables on mechanical and physical properties, ASME code requirements, recommended welding procedures. The International Nickel Co., Inc.

208 Double-Walled Tubing — Technical Bulletin 1950, 12 pp, presents tubing designed for conditions where single-walled tube can't withstand simultaneous attack from two types of corrosive media. Describes and illustrates construction, illustrating possible metal combinations. Explains tubing's use in ammonia refrigeration, boilers, steam generators. Discusses heat transfer properties, high temperature use. Bridgeport Brass Co.

209 To Avoid Tube Corrosion — Bulletin TR-514 is an 8-pp illustrated article discussing corrosion as a major factor in shortening the life of boiler tubes. Indicates that, in low pressure boilers, corrosion is the largest single cause for replacement of tubes. Points out types and causes of corrosion and gives general rules to follow to get maximum service life from boiler tubing. Tubular Products Div., The Babcock & Wilcox Co.

210 Tube Cleaners — Catalog 76-A provides 48-pp of information on manufacturer's line of tube cleaners. Following equipment selection and operating hints, this practical catalog describes and pictures cutter heads and drill heads, brushes, and motors, giving sizes, application information. Electrically driven equipment, air valves, hose, lubricators presented. Thomas C. Wilson, Inc.

211 Rotary Tube Cleaners — Bulletin R-105 presents air and water driven rotary tube cleaners and cleaner accessories. Illustrates several models and heads, discussing special features. Roto Div., Elliott Co.

FUEL BURNERS

212 Gas Burners — Illustrated Bulletin 410-8, 16 pp, furnishes descriptive and technical data on company's gas burners and combination gas and oil burners, giving design details and explaining operation of each type. Coppus Engineering Corp.

213 Oil Burning Equipment — Bulletin O-B, 37 contains 16 pp of technical information on company's oil and gas burning equipment, steam atomizing burners, mechanical atomizing burners, interchangeable burners, telling best applications, including capacity data. Also shows fuel oil pumping, heating systems. The Engineer Co.

214 Steam Atomizing Oil Burners — Sixteen-pp illustrated Bulletin 21 describes steam atomizing oil burners and auxiliary equipment for use with heavy oil or tar in boilers, stills, dryers and other furnaces, where steam or compressed air is available for atomizing the oil. Discusses steam and oil control valves. National Airoil Burner Co., Inc.

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Use this space to ask for tear sheets and other information. .....

FUEL OILS, LUBRICANTS

215 Cooperative Technical Consultation Service — This informative 24-pp booklet presents company's periodic consultation service aimed at the most efficient use of petroleum products. Covers services available in the solution of lubrication problems, metalworking operations, processing, fuel oils, dust control. Gulf Oil Corp., Gulf Refining Co.

216 Air Compressor Lubrication Manual — Valuable information on air compressor maintenance is contained in this 40-pp book. Subjects treated include compressed air, compressors and related equipment, lubricating systems, compressor oils and applications, lubrication requirements, operating hints, oil requirements, storage and care of compressor oils, safety precautions. Cities Service Petroleum, Inc.

217 Lubrication of Diesel Engines — An excellent instruction manual, 50-pp Technical Bulletin B-1 (revised) also provides a brief history on diesel engines, an explanation of the fundamentals of design and the common types of diesels and their advantages. Explains combustion process, discusses modern fuel injection systems. Cylinder and bearing lubrication are treated and recommendations given for lubricating oils. Sun Oil Co.

218 Diesels, Their Fuels and Lubricants — This 46-pp book gives practical information on diesel engines, covering their history and economics as well as design characteristics and operating principles. Classification of diesels according to their speed is also explained. Sinclair Refining Co.

219 Clean Oil for Diesels — A combination purifying and filtering unit utilizing centrifugal force and controlled filtration is the subject of illustrated Bulletin DL-1. Explains operation of the unit, tells advantages. Discusses importance of clean, dry lubricants. The De-Laval Separator Co.

220 Versatile Industrial Oil — Described in 20-pp Form AD 4078 is an all-purpose oil offering protection for a wide range of industrial equipment, and available in 15 viscosity grades. Discusses six major characteristics of the oil; explains and pictures its use in hydraulic systems, speed reducers, air compressors, electric motors, hydraulic turbines, bearing systems, etc. A chart shows grades available, their uses and physical properties. Standard Oil Co. (Ind.)

PUMPS AND COMPRESSORS

222 Centrifugal Pump Handbooks — Two instruction booklets covering the installation, operation and repair of company's single-stage single-suction and multi-stage centrifugal pumps are available. Suggest regular inspection procedures and include pages for maintenance records. Also provide handy tables explaining how to locate trouble and listing causes and cures. Bulletin 08X7813, 24 pp, covers single-stage pumps; Bulletin 08X7780, 48 pp, covers the multi-stage pumps. State choice or both. Allis-Chalmers Mfg. Co.

223 Rotary Pump Service Manual — The installation, operation and maintenance of rotary pumps are covered in 12-pp Service Manual 100-2. Subjects discussed include in-

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The Niagara's Controlled Humidity Method using HYGROL moisture-absorbent liquid is

Best and most effective because . . . it removes moisture as a separate function from cooling or heating and so gives a precise result constantly and always. Niagara machines using liquid contact means of drying air have given over 20 years of service.

Most reliable because . . . the absorbent is continuously reconcentrated automatically. No moisture-sensitive instruments are required to control your conditions.

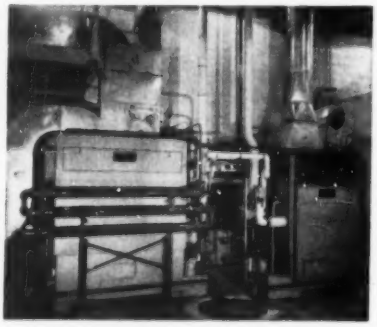
Most flexible because . . . you can obtain any condition at will and hold it as long as you wish in either continuous production, testing or storage.

Easiest to take care of because . . . the apparatus is simple, parts are accessible, controls are trustworthy.

Most compact, taking less space for installation.

Inexpensive to operate because . . . no re-heat is needed to obtain the relative humidity you wish in normal temperature ranges and frequently no refrigeration is used to remove moisture.

The cleanest because . . . no solids, salts or solutions of solids are used and there are no corrosive or reactive substances.



Niagara Controlled Humidity Air Conditioning

This method removes moisture from air by contact with a liquid in a small spray chamber. The liquid spray contact temperature and the absorbent concentration, factors that are easily and positively controlled, determine exactly the amount of moisture remaining in the leaving air. Heating or cooling is done as a separate function.

For complete information write

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Dept. PE, 405 Lexington Ave., New York 17, N. Y.

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stalling of foundation bolts, alignment, supporting vertical pumps, grouting, piping, suction lines, hot liquid pumps, rotation, packing, dismantling, reassembly, starting, operation and standing idle. Warren Steam Pump Co.

224 Condensed Pump Data — Form 4383-J covers more than 20 types of general service pumps, rotary pumps, sump and drainage pumps, condensate units, self-priming units, stainless steel pumps and high pressure pumps. In easy-to-find tabular form, each model is pictured along with its characteristics, applications, features and references to specific literature providing further information. Lists selection factors. Goulds Pumps, Inc.

The postage-free cards on pages 38 and 136 may also be used to ask for information on advertised products. Just circle the number appearing below or above the ad

225 Controlled Volume Pumps — Bulletin 351, 16 pp, describes company's air-powered controlled volume pumps, designed to pump practically any liquid in measured volumes accurate to within a fraction of 1 per cent. Pumps are reciprocating, positive displacement plunger types. Cross-sectionals show design and operating details. Controls and typical automatic feed systems are discussed. Milton Roy Co.

226 Boiler Feed Pump — A barrel-type boiler feed pump for high pressure, high temperature service and designed to go on the line quickly without preliminary warm-up, is the subject of 12-pp Bulletin 1525. Fully illustrated text explains automatic operation of hydraulic thrust balance incorporated in this pump. De Laval Steam Turbine Co.

227 For Controlled Volume Pumping — Bulletin 300, 24 pp, describes Pulsafeeder piston-diaphragm pumps, stressing their no-stuffing box feature and noting that although basically a pump, this unit can do the work of a chemical feeder, a meter, an instrument, a filling machine, a proportioner and a sampler. Process Equipment Div. Lapp Insulator Co., Inc.

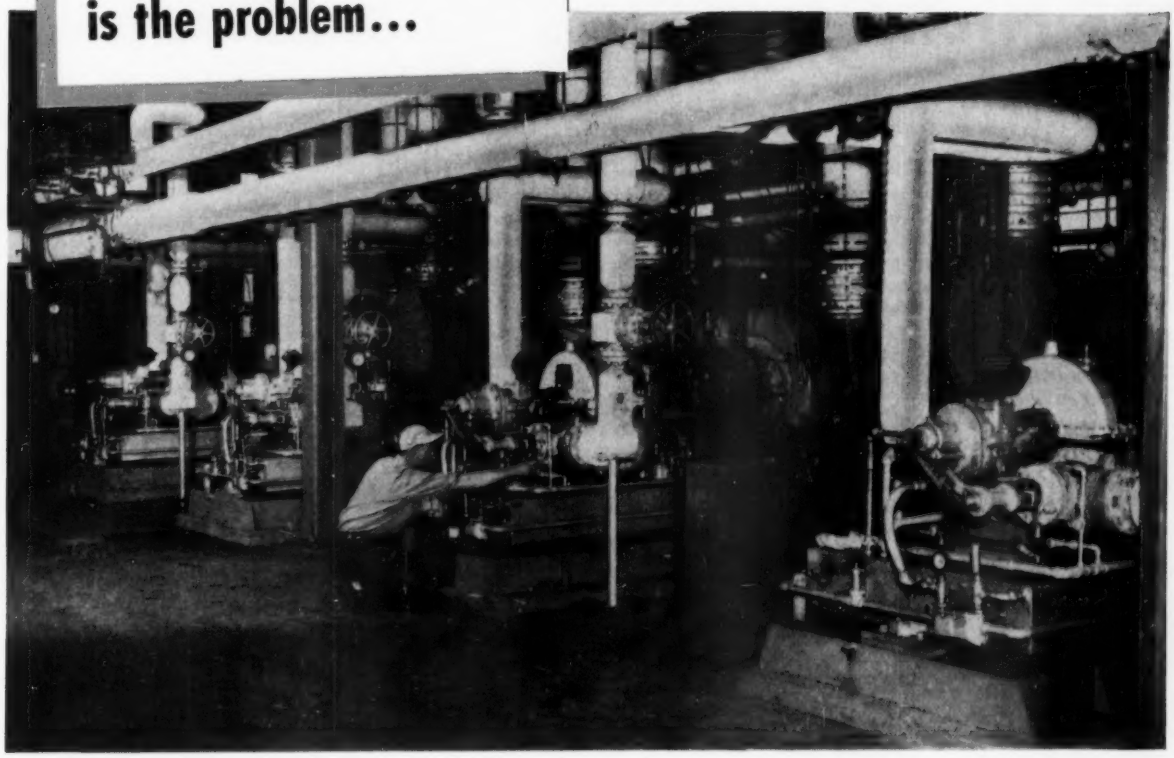
228 Compressor Selection Chart — Based on normal applications handling air with atmospheric intake pressure, this chart simplifies selection of proper size compressor, giving quick comparison between discharge pressure pounds per square inch gage and piston displacement cubic feet per minute. Worthington Corp.

PACKINGS, GASKETS, SEALS

229 Packings and Gaskets — Catalog P-100C, 32 pp, covers 95 most popular packings and gaskets in company's line, furnishing details of construction, service recommendations and size information. Includes charts showing specific recommendations for a wide variety of applications. Packing Div., Raybestos-Manhattan, Inc.

230 Seals for Bearings — Complete information on manufacturer's Klozure oil and grease seals for bearings is

Where fluctuating load is the problem...



TYPE E gearturbines can handle it!

Process requirements in the evaporator room of the Masonite Plant, Ukiah, California, called for a variable-speed pump drive to provide for fluctuating load conditions. Steam was available. In the words of this user: "Westinghouse Type E, Close-coupled Gearturbines were selected since the pumps had to operate at relatively low speeds, and the higher efficiency inherent in the high-speed turbines was desirable. In operating performance, these turbines have proved the most efficient and economical solution to our problem."

Also in the evaporator room, the Masonite Company selected four Westinghouse Type E Turbines to drive the boiler feed pumps. These turbines provide an efficient, trouble-free drive which can be driven by the existing steam supply. Motor-driven units are used as stand-bys.

This use of both types of Westinghouse Turbines is the kind of over-all unit responsibility that actually makes your job of purchasing, installation, and maintenance easier . . . more dependable.

Wrapped up in a single package is a compact, rugged, and reliable speed-reduction unit solidly coupled to a Type E turbine. Each gearturbine is mounted on an extremely rugged base, fabricated of heavy steel plate which forms the oil reservoir. This arrangement simplifies mounting and installation. It provides operating stability never before available.

Get the full story on the broad Westinghouse turbine line. Book B-4346 clearly explains the applications, refinements and distinct standard features of Westinghouse Gearturbines. Call your nearby Westinghouse office, or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Penna.

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Westinghouse

TYPE E Turbines

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For Temperature Control

$35 Nicholson Trap Replaces $200 Unit

Again demonstrating their remarkable effectiveness as a low-cost temperature control, a large processor reports Nicholson expansion steam traps, at about $35 each, are being installed on outdoor tanks and stills in place of temperature controls. These were costing $110.00 to $200.00, with cost of trap added.

The Nicholson traps are readily adjusted to pass condensate at any temperature below 212°F. Easily installed, usually without supports. Pressures, 0 to 250 lbs.

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Now available in pipe covering and block insulation, Mundet 85% Magnesia permits new heat-saving efficiency. Precision manufacturing on the latest type of automatic equipment insures uniform standards. Extra durability is built into the insulation. It does not "powder", settle or disintegrate. It is unaffected by either steam or water leakage. It maintains an attractive, smooth finish. Precision pipe fit is assured, with no spaces left for the escape of heat. You benefit from the most modern manufacturing facilities for the production of heat insulation. Write for specification information and recommendations. Mundet Cork Corporation, Insulation Division, 7115 Tonnelle Avenue, North Bergen, N. J.

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available in 100-pp Catalog 10. Fully illustrated in color, pictures all types of these seals, typical applications and lists sizes and part numbers. Also describes mechanical pressure seals for rotary shafts. The Garlock Packing Co.

231 Manual on Packings — Containing 84 pp of engineering and ordering information, Catalog 40 covers packings for practically every service. Includes packaging recommendation charts, conversion tables. The Belmont Packing & Rubber Co.

232 Packings for the Power Plant — Designed as a quick-reference aid, one feature of this compact 6-pp guide is a flow sheet of a rudimentary industrial power plant with each unit keyed to the proper packings and gaskets. These, in turn, are illustrated with photos and construction information, sizes, etc. Packings and gaskets are grouped according to recommended applications and services. Johns-Manville.

VALVES, TRAPS, PIPING AND ACCESSORIES

233 Pressure Reducing Valves — Selection and engineering data on pressure reducing valves, including those for remote control or reduced steam or water pressures, are in 12-pp Bulletin 477-A. Copes-Vulcan Div., Continental Foundry & Machine Co.

234 Safety Valve Engineering Data — How company's safety valve works and its operating advantages are explained in Bulletin 707. Includes dimensions on valve types, tables on superheat correction factor. Manning, Maxwell & Moore, Inc.

235 Popular Steel Valves — Condensed Catalog 104, 28 pp, describes and illustrates most widely used of company's cast and forged steel valves and the data presented for these valves is complete. Those listed are chiefly in the basic steam pressure classes — 150 to 2500 lb — and include globe and angle, gage, instrument, hydraulic and relief types, also strainers and check, gate, non-return and blow-off valves. Edward Valves, Inc.

236 Regulating Valves — Bulletin 313 describes double seated diaphragm regulating valves for use with control instruments, outlining special features of the valves, particularly the "flow line" contoured body engineered to provide for high capacity at low pressure drop. Leslie Co.

237 Check Valves — Twenty-pp Catalog 30 presents company's line of tilting-disc check valves made in iron, bronze and steel for working pressures to 3000 psi. Explains operating principle of tilting disc construction, discusses closing without slam, reduced loss of head, other advantages. Includes construction details, sizes. The Chapman Valve Mfg. Co.

238 To Get at Those Valves — This little folder describes a sprocket rim with chain guide. The rim adjusts to fit all sizes of valve wheels. Babbitt Steam Specialty Co.

239 Valve Specialties — Included in 90-pp Catalog A-50 is ordering and engineering information on automatic pressure flow and liquid level controls for steam, air, gas, water, oil, other fluids. Sections are devoted to pressure regulators, altitude valve, pump governors and strain-

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ENGINEERING News

JET APPARATUS • HEAT TRANSFER EQUIPMENT • STRAINERS • CONDENSERS AND VACUUM PUMPS • OIL BURNING EQUIPMENT • [illegible]

SK OIL BURNERS, GEAR PUMPS ASSURE CONSTANT BOILER PRESSURE

(Photos and story by courtesy of Stephen F. Whitman and Son, Inc.)

Candy manufacturing processes at WHITMAN'S Chocolates are highly mechanized. Constant boiler pressure must be maintained to operate the various processing equipment which controls the quality of WHITMAN'S fine candies.

Three boilers, each equipped with two burners are responsible for developing 375,000 pounds of steam per day at the company's Philadelphia plant.

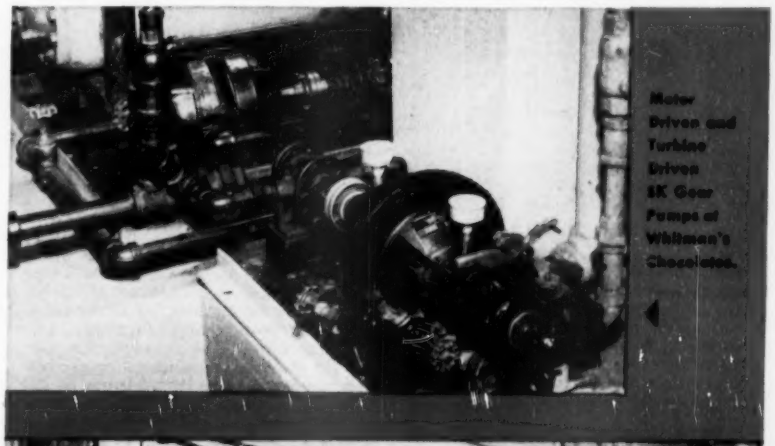
Boiler loads fluctuate widely, due to the complexity and operating demands of the processing equipment. With a minimum of effort, load fluctuations are easily met and boiler pressure held constant.

According to WHITMAN'S Plant Engineers, SK Oil Burners have the outstanding advantages of high efficiency, low maintenance and simple construction. These burners were installed in 1939. Since then, a minimum of maintenance has been required. The only parts replaced have been spirals, tips and goosenecks. Downtime has been negligible since these parts are easily and quickly replaced.

To insure a continuous flow of heavy fuel oil to the burners, a motor driven SK Gear Pump is used. Another SK motor driven pump and a steam turbine driven SK Gear Pump are utilized as standbys. The turbine driven unit is especially selected to protect operation in the event of electric power failure.

Highly viscous Bunker C Fuel Oil, preheated at 90° to 100° F., is pumped to the main oil heaters and thence to the burners at proper atomizing and burning temperature. WHITMAN'S engineers report that SK Gear Pumps have proved highly satisfactory in their plant because the pumps: (1) operate continuously; (2) pump oil at even pressures; (3) require a minimum of maintenance.

Bulletin 17-A covers — in detail — the wide range of Gear Pumps manufactured by SK. Complete information on SK Mechanical Fuel Oil Burning Systems is contained in Bulletin 16-A. Send for free copies.



Motor Driven and Turbine Driven SK Gear Pumps at Whitman's Chocolates.

SK Mechanical Fuel Oil Burning Units installed in boiler room at Whitman's.

SCHUTTE and KOERTING Company
Manufacturing Engineers
54 CORNWELLS HEIGHTS
BUCKS COUNTY, PA.
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Close-up view of leaf-type filter used with Sorbo-Cel by Pullman-Standard

How Pullman-Standard operates boilers on a

1% blow-down basis...

with SORBO-CEL

At the Haskell & Barker plant of Pullman-Standard Car Mfg. Co., Sorbo-Cel solved the major filtration problem of removing oil from condensate returned to the two new 50,000 lb-per-hr 400 psi, 750-F boilers.

Pre-Coat Sorbo-Cel and regular Sorbo-Cel, specially processed high flow-rate diatomaceous silica powders, are used on leaf-type filters. After a film of Pre-Coat Sorbo-Cel has been built up on the filter screens, regular Sorbo-Cel is added continuously to the unfiltered water. This means a new filter surface is constantly presented to the oncoming water.

Results . . . Water filtered by Sorbo-Cel contained less than 0.1 ppm of oil . . . and boilers have since been operated on a *one per cent* blow-down basis.

Send coupon below for bulletin giving data on this low-cost way to remove oil from water. No cost or obligation.

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Johns-Manville PE-2
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Please send me free bulletin giving advantages of Sorbo-Cel filtration.

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ers; lever, float and motor operated valves; pilot valves; back pressure, relief and non-return valves, stream trap and air vent; liquid level controllers; solenoid valves. Davis Regulator Co.

240 Solving Steam Trap Problems — This popular 36-pp catalog on steam traps contains specifications and capacities on steam traps, float traps, air release valves and pipe line strainers. Tells how to calculate condensation loads and select traps for all classes of equipment, including unit heaters, jacketed kettles, autoclaves, submerged surfaces, steam mains and header drips. Gives pointers on how to install and service traps. The V. D. Anderson Co.

241 Steam Trap Book — Catalog J is the 44-pp new edition of this company's popular trap book and serves as a manual of trapping practice. Includes a catalog section giving physical data and prices on cast semi-steel and forged steel inverted bucket steam traps, compound steam traps and ball float air and air relief traps; a handbook section explaining how to calculate condensate loads and select traps for all classes of equipment; a maintenance section explaining trap installation, trouble-shooting and repair. Armstrong Machine Works.

242 Steam Trap Reference Manual — Bulletin T-1740, 24 pp, tells why and where steam traps should be used; explains desirable trap features. Advantages of company's impulse steam traps are described, their operation illustrated. How to figure trap sizes and how to size condensate return lines are told and capacity and pipe dimension charts and thermodynamic properties of saturated steam included. Also provided are installation and operating suggestions, prices. Yarnall-Waring Co.

243 Steam, Air and Gasoline Traps — Illustrated Catalog 751, 32 pp, provides capacity tables, installation diagrams and a section containing data, charts and formulas for determining proper size trap for specific applications. Covers thermostatic steam traps for pressures to 225 lb, expansion steam traps, weight-operated traps for steam, air and gasoline as well as piston-operated steam traps. W. H. Nicholson & Co.

244 Piping Pointers — This is company's highly popular 36-pp manual covering fundamentals of sound piping practices. Discusses various types of valve designs and how each should be used. Pictures and names more than 80 fittings and contains illustrated how-to-do-it features. Includes 8 pp valve selection guide. Crane Co.

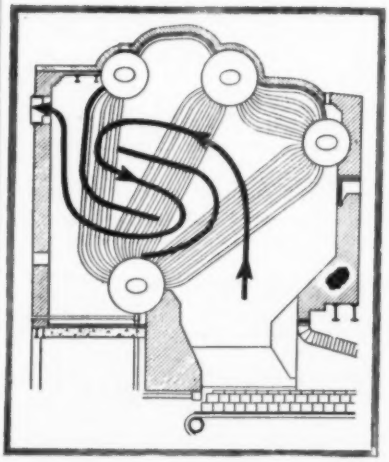
245 Valves, Fittings and Flanges — Catalog F-9 is a 400-pp, permanently bound reference book on drop forged steel valves, fittings and flanges for practically all piping needs at high and low pressures and temperatures. Provides ordering information on company's complete line, also much helpful engineering and application data: includes a section on products for refrigeration service. Available to qualified power engineers; please give your title. Henry Vogt Machine Co.

246 Unions and Fittings — Twelve-pp Catalog 50 covers manufacturer's line of unions of all types, elbows, tees and fittings. It describes and illustrates special features. Dart Union Co.

These important fuel-saving, maintenance-reducing features are obtainable with Enco boiler baffles — *and only with Enco baffles.*

- **Streamlined gas flow**
- **Uniform gas flow**
- **Elimination of bottle necks**
- **Reduced draft losses**
- **Higher heat transfer**
- **Cleaner heating surfaces**
- **Less use of soot blower**
- **Special provision for expansion**
- **Easy tube replacement**
- **Adaptable to any water-tube boiler, fired by any fuel**

Each application is designed on the basis of more than a quarter century of experience in this specialized branch of power engineering. Installations are made by skilled mechanics.



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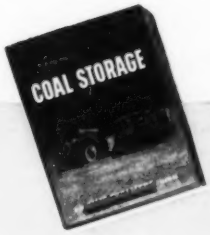
1. ADD FLEXIBILITY. Store coal wherever there is available space . . . and reclaim it any time. A-C crawler tractors, equipped with loaders, bulldozers or scrapers travel anywhere . . . over any ground. And in rush periods, you can speed up operations temporarily by transferring additional tractor units to the job.

2. HAVE EXTRA FIRE PROTECTION. When A-C tractor units store coal, they spread it in thin layers and compact it by constant travel over the pile. The tight packing of horizontal layers eliminates the flues that cause spontaneous combustion in loose conical piles.

3. REDUCE EQUIPMENT INVESTMENT. The Allis-Chalmers tractor method is considerably more economical and flexible than complex conveyor or crane systems — which means savings in original cost as well as lower cost per ton for coal handling. And tractor units can also be used for such jobs as plant and yard maintenance, material handling, car spotting and snow removal.

Send for free booklet, "Economic Coal Storage with Allis-Chalmers Tractors." Describes modern coal-handling methods, using A-C tractors and 'dozer blades, front-end loaders and scrapers. Write Allis-Chalmers Tractor Division.



● HD-5G Tracto-Shovel stockpiling coal at a large industrial plant in Cleveland... has averaged 2500 tons a month for a year and a half without ever being down for repairs.

● Four A-C tractors with Gar Wood scrapers bring real flexibility to the coal handling operations of an Ohio utility. They haul as far as 1,700 feet . . . store wherever there is available space.

Four Diesel-Powered Models . . . 11,250 to 41,000 lb.

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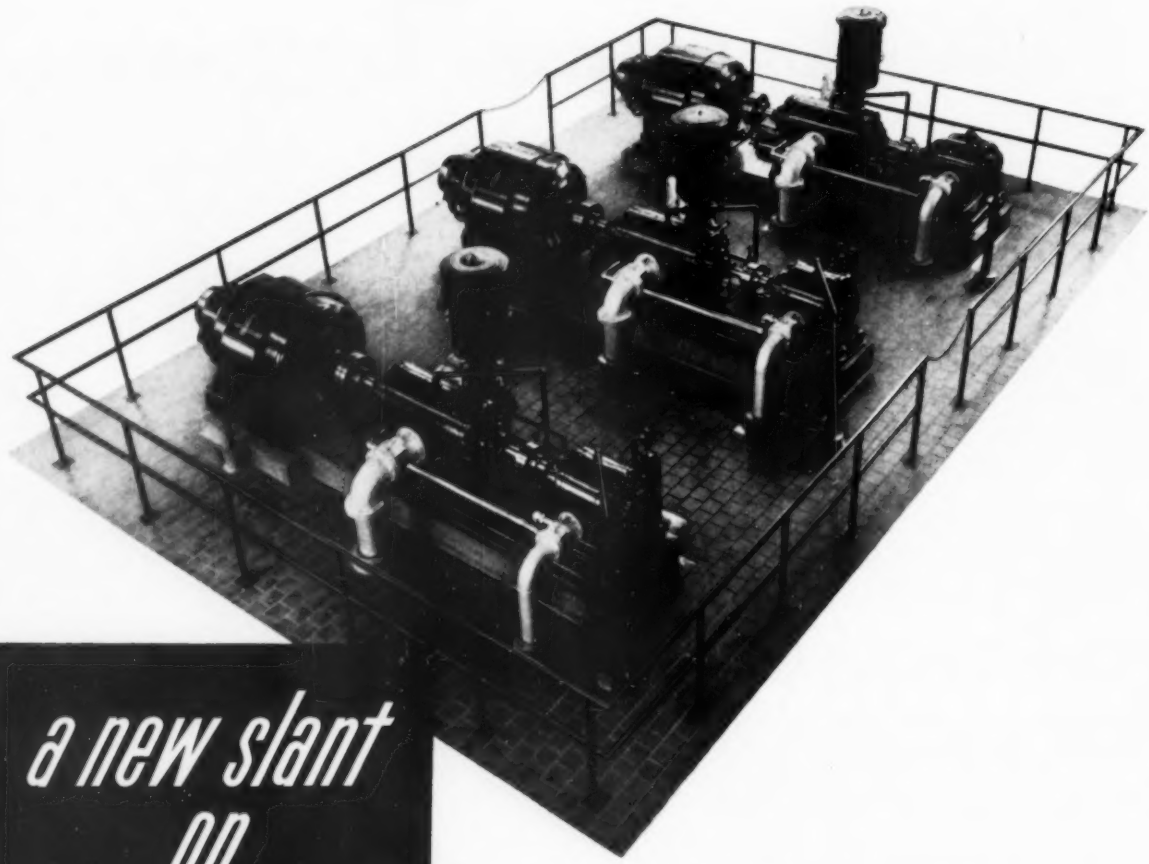

a new slant on compressors

***simple *compact *direct drive**
***valveless *vibrationless *pulseless**

If you've never considered the advantages of Fuller Rotary Compressors and Vacuum Pumps, now is the time to do so.

Fuller Rotaries have many unique and beneficial advantages for you. For instance, they can be placed almost anywhere out of the way, because their vibrationless, rotary action permits, for example, balcony installation. Because they operate by direct drive, you eliminate the initial and maintenance costs, as well as transmission losses incident to gear and belt drives. Maintenance costs are kept to a minimum.

Because Fuller Rotaries compress without reciprocating pistons, you get a non-pulsating air stream. They are extremely compact for the volume delivered; sizes to deliver up to 3300 cfm. free air, for pressures from atmosphere to 125 psig. Write today to the Fuller Company, Catasauqua, Pa. for literature and engineering data.

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Catasauqua, Pa.

Pioneers of high efficiency vane-type rotary compressors

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ELECTRICAL

247 Electrical Maintenance Tips — Booklet B-5477, 28 pp, gives a complete outline of preventive electrical maintenance. Discusses general maintenance programs designed to reduce shutdown time and treats in detail the maintenance of power equipment. A suggested schedule of work and cleaning on power equipment is presented in chart form. Essential information on preventive maintenance for turbines, generators, switchboards, motors, controls is provided. Westinghouse Electric Corp.

248 Wire, Cable Ordering Guide — Newly-released General Catalog W-52-3, 186 pp, presents more than 500 different types of wires and cables. Contains comprehensive data on construction and operating characteristics for control and signal cables, cables for construction work, telephone wire and cables, and portable cords. A detailed technical engineering data section is also included. United States Rubber Co.

249 Watthour Meter Selection Tips — Here is a handy pocket-size guide, 52-pp worth, giving all necessary information needed to select and install any of the company's watthour meters. The bulletin, GET-2376, explains uses of the meters while pointing out basic considerations pertinent to selection. Illustrations and circuit diagrams included. In addition, instrument transformers and demand devices are discussed for energy and power measurement. General Electric Co.

INSTRUMENTS AND CONTROLS

250 Meters and Control Systems — Integrated control systems and individual meters for these systems are shown in 12-pp Bulletin 15-H. Boiler, combustion and feedwater controls are singled out for special attention, complete with photographs and schematics. Also included are measurement requirements for steam temperature, condensate, boiler feed pump control. Bailey Meter Co.

251 Supervisory Instruments — Catalog 90-2, "Supervisory Instruments for Power Generation," consists of 41 pp on the instrumentation involved in generating stations. Separate sections cover steam generation instrumentation, turbine and generator instrumentation, electrical distribution instrumentation and diesel engine instrumentation. Measurement of temperature, pressure, flow, power generation and other variables discussed. Brown Instruments Div., Minneapolis-Honeywell Regulator Co.

252 For Practical Men — This 24-pp pocket-size booklet presents insulation testing in simple language. Packed with maintenance hints, explains electrical insulation, tells how it can be tested and what makes it go bad. It describes the Megger insulation tester and justifies its cost in long run economy. James G. Biddle Co.

253 Industrial Thermometers — Catalog 125, 28 pp, presents ordering data on a wide range of industrial thermometers, giving scale ranges, dimensions and prices. Features company's Adjust-Angle thermometer designed for use at any angle front to back, left or right, through a 180 deg arc. Gives construction details and advantages of this adjustable-stem type instrument. Weksler Thermometer Corp.

254 Steam Calorimeter — Bulletin 118 discusses an improved U-path calorimeter combining a throttling, separating and re-evaporating calorimeter in a single chamber. Explains construction and operation of the unit. Ellison Draft Gage Co., Inc.

255 Easy Reading Gage — An all-hydrostatic remote reading gage for boiler water and other liquid levels is described in Catalog 500, Section CO. Pictures improved visibility, other advantages offered by this gage, explains operation. The Reliance Gauge Column Co.

256 Sight Glass Flow Indicators — Twelve-pp Bulletin 18-W, on company's line of flow indicators, shows how these mechanical devices indicate fluid flow and its direction in pipelines which can be directly observed through a sight glass and are suitable for service with liquid, gas, vapor, slurry or sludge sufficiently translucent to permit observation of indicating element. Schutte and Koerting Co.

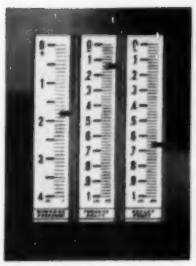
257 Gage Glasses — This folder describes company's Sonderglass boiler gage glasses available in clear or reflecting types. Tells merits of these hand-made glasses, stressing strength of double-layer construction. Includes prices. A. W. Chesterton Co.

MAINTENANCE

258 Chemical Cleaning Service — Reduced maintenance costs and outage time are among advantages of company's chemical cleaning service for steam equipment and water lines discussed in this 8-pp bulletin. Before-and-after photos show some actual cleaning jobs and

EASIER TO *Read*

Beside the foolproof, precision mechanism which insures utmost accuracy in ELLISON Draft Gages, they are easier to read—both the Straight-Line and Dial type gages. Scales are of translucent glass with distinct black graduations printed on the glass by special process. Accurate readings from any viewpoint.



With engineers who want freedom from gage worries it's ELLISON. Bulletin 122 describes Straight-Line and Dial Bell Gages —Bulletin 124 for Straight-Line Diafram Gages.

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550 W. MONROE ST. *Since 1896* CHICAGO 6, ILL.

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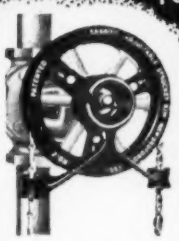
VALVE CONTROL AT LOWEST COST!



Babbitt *Adjustable* SPROCKET RIM *with Chain Guide*

INSTALLED, AND OPERATING, IN ONLY A FEW MINUTES

Range of 10 ADJUSTABLE sizes fits all valve wheels, with rising or non-rising stems, from 2 to 30 inches diameter.

●

Distributors in principal cities, or send for Catalog Folder PE-2 and name of nearest distributor.

● Here's easy, convenient, instant control of overhead, out-of-reach valves—right from the floor! No expensive apparatus, no switches, nothing to break down when needed most! BABBITT Adjustable Sprocket Rim with Chain Guide is installed in a few minutes, and gives you positive, efficient valve control. Low initial cost is last cost! Prevents accidents, prevents waste, saves money!

BABBITT STEAM SPECIALTY CO.

1 Babbitt Square, New Bedford, Massachusetts

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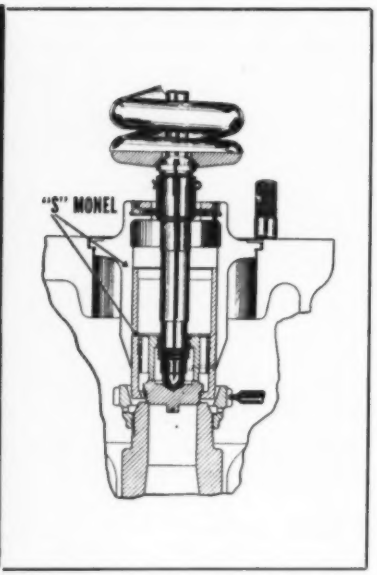
'S' Monel...

FOR RESISTANCE TO GALLING AND EXTRA HARDNESS AT HIGH TEMPERATURES



"Consolidated" Safety Valves like this have guide sections of extra hard "S" Monel. Manning, Maxwell & Moore, Inc., standardized on "S" Monel after extensive tests under simulated operating conditions. All proved "S" Monel an outstanding metal for resistance to galling and seizing.

Are you looking for a casting alloy for parts subject to high stress and severe friction under corrosive conditions?

Then take a look at "S" Monel.

"S" Monel is one of the hardest and strongest of the non-ferrous casting alloys.

Its coefficient of expansion closely matches that of carbon steel to give excellent service where clearances are small and operating temperatures high.

"S" Monel retains its hardness at elevated temperatures. It resists galling under severe conditions, even where lubrication is poor.

And because of its hardness it is highly resistant to abrasion and erosion.

It can be machined as cast. For extensive machining the casting may first be annealed and later age-hardened to develop its maximum hardness. It is not recommended for welding.

You'll find "S" Monel used as the guiding parts in safety valves, in valve discs and seats, impellers, wearing rings, bushings, sleeves, ejector nozzles and pump liners.

"S" Monel has helped many manufacturers in solving their metal selection problems.

Take for instance the problem of Manning, Maxwell & Moore, Inc.

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(Annealed and Age-hardened)

Yield Point	80-115,000 psi
Tensile Strength	120-145,000 psi
Elongation in 2-in.	4-1%
Hardness (Brinell)	300-375
Coefficient of Thermal Expansion (32°-212°F.) in./in/°F.	.0000068

Hardness of "S" Monel at Elevated Temperatures*

(As-cast condition)

Temperature, °F.	Brinell Hardness
Room	321
700	321
800	311
900	311
1000	321
1050	335
1100	293

**Average properties—not to be used for specification.*

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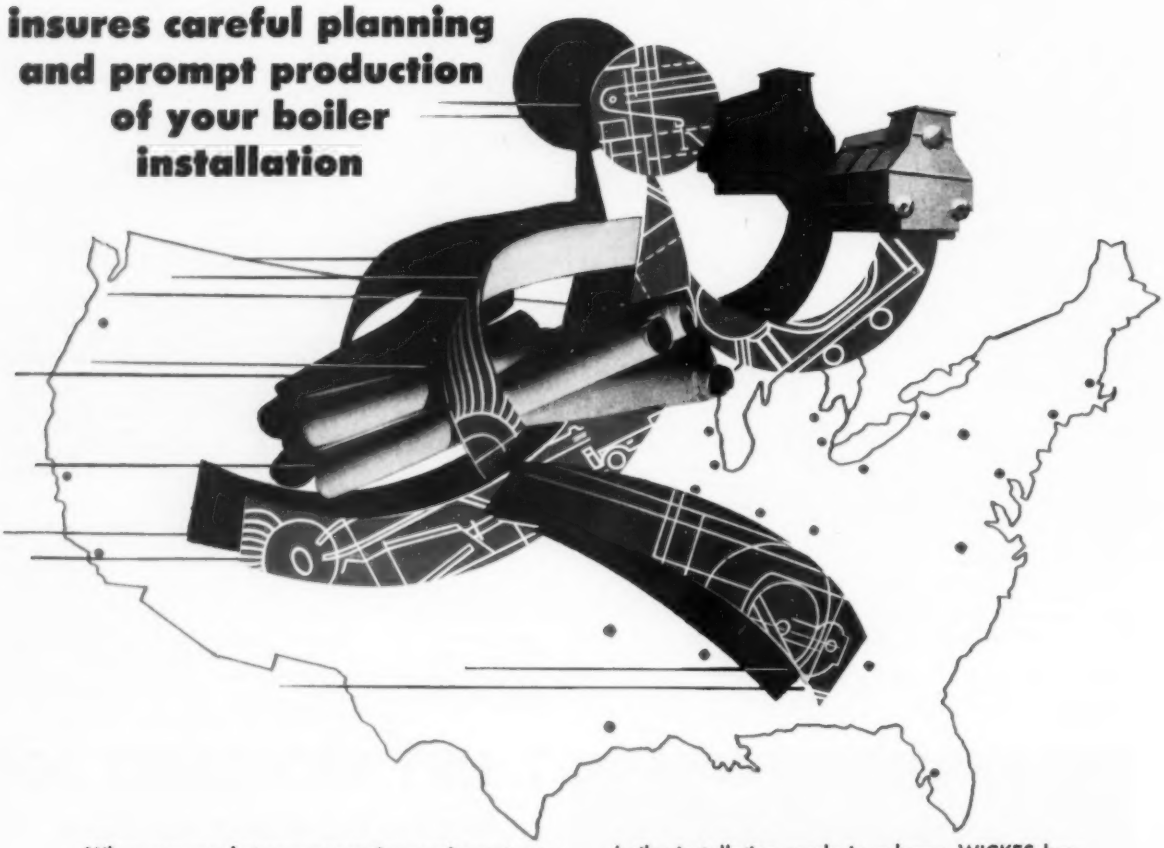

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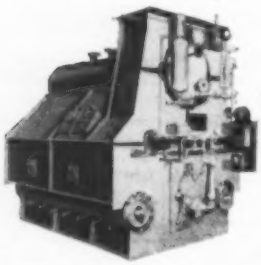

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270 Finned Tube Heat Exchanger — Bulletin 1400, 20 pp, fully describes the company's G-R Twin G-Fin Section heat exchanger. The unit has wide application for heating and cooling liquids and gases, and for condensing vapors, according to the company. Suitable as boiler feedwater preheaters, fuel oil heaters, etc., features of design and construction are given. Specifications and dimensions are included. Many illustrations show representative illustrations along with reports of service records. Griscom-Russell Co.

271 Heat Exchanger for Process Industries — Bulletin HF-101, 8 pp, introduces the Holo-Flight Processor, a new heat exchanger. Tells how it affords control of the flow of material as to duration of treatment, and control of the quantity and temperature of heat exchange agent. Western Precipitation Corp.

REFRACTORIES, INSULATION

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273 Industrial Insulations — Just released, this 20-pp catalog describes insulating materials covering the temperature range from — 150 to 1800 F, and including cement, block, blanket, felt and pipe covering. Complete with thermal-conductivity graphs and heat loss charts, catalog also shows list prices. Brief application descriptions included, also typical uses, sizes, packaging, densities. Baldwin-Hill Co.

274 Heat Insulation Data — This is a 12-pp illustrated engineering and specification manual describing applications for 85 per cent Magnesia heat insulation. Provides data on heat savings per pipe thickness, for heat ranges to 600 F. Includes charts for determining thickness standards for pipe covering, with tables for heat calculations. Mundet Cork Corp.

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276 Coal Scale — Bulletin 0250, 12 pp, describes a pressure-tight, automatic coal scale, its construction and operation. Shows how beam system, electrical components and linkages are protected from exposure to coal dust. Richardson Scale Co.

277 Economic Coal Storage — How tractors establish safe, orderly coal handling is told in this 8-pp booklet. Stresses flexibility, low operating costs. Also shows how tractors speed storage reclamation and how a tractor-scraper combination offers plus benefits. Illustrated with action photos; picture several models. Tractor Div., Allis-Chalmers Mfg. Co.

278 Why Liquid Diffusion — What liquid diffusion can do for power plants is explained in Form B, which tells how liquid diffusion compounds work and gives four practical applications. These include dust control in coal handling, fly ash control, coal storage pile treatment and boiler cleaning. Johnson-March.

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279 Ejector Instruction Manual — Bulletin J-50-7 is a 36-pp. handbook covering operation, selection, installation and maintenance of steam jet air ejectors. Discusses twin and triple element ejectors, surface and jet inter- and after-condensers, isolating valves, drain traps, steam and back pressures, steam nozzles. Foster Wheeler Corp.

280 The ABC of CO_2 — An interesting text covering role of carbon dioxide in combustion efficiency, 16-pp illustrated Bulletin 452 discusses theoretical vs practical perfection of combustion and tells how to determine percentage of CO_2 in flue gases. CO_2 as a basis for figuring heat and fuel losses is also described and method of determining such losses explained. The Hays Corp.

281 Air Preheaters — Illustrated Bulletin A-11610, 8 pp, defines air preheat and explains its benefits in terms of increased efficiency and capacity and flame stability. Provides general description of company's Ljungstrom preheater. The Air Preheater Corp.

282 Turbine Generators — Bulletin H-18, 40 pp, covers turbine-generators of 500 kw and above, pictures nearly 50 turbine-generator installations, both utility and industrial. Brief discussions of generator and exciter cooling methods are included. A reference section offers detailed drawings showing a typical installation arrangement. Elliott Co.

283 Mechanical Draft Fans — Mechanical draft fans for both forced and induced draft service are described in 20-pp Bulletin 168. Illustrated with drawings of typical fan types and photos of installations, includes performance curves showing efficiencies of various types of fans. The Green Fuel Economizer Co., Inc.

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Robert W. Pixler, Laboratory Supervisor for Eclipse Fuel Engineering Company, Rockford, Illinois writes:

"It did not seem possible that an instrument that is so fast and direct-reading could possibly have the accuracy we demand. But, we found the Heat Prover equally exact, possibly even more exact, than standard commercial testing equipment.

"Our test work with previous instruments was a long, drawn-out affair. But with the Heat Prover, we completed what would normally have been a 30-hour test in just 6 hours!...and we doubt that our old equipment could have maintained the accuracy delivered by Cities Service Heat Prover."

WHEREVER A FURNACE OPERATION IS INVOLVED, the Heat Prover can help increase productivity by providing:

- **Rapid, continuous sampling**
- **Simultaneous reading of oxygen and combustibles**
- **Direct measurement of oxygen and combustibles**
- **Easy portability**
- **No maintenance; no re-calibration**

For details, contact nearest Cities Service office or write Cities Service Oil Company, Dept. B17, Sixty Wall Tower, New York City 5, N. Y.

QUALITY PETROLEUM PRODUCTS

CITIES SERVICE

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HALL INDUSTRIAL WATER REPORT

Hall Laboratories, Inc.—A Subsidiary of Hagan Corporation, Pittsburgh, Pa.

Volume 1 | FEBRUARY 1953 | Number 1

New Water Manual Published by ASTM

Of interest to everyone concerned with industrial water is ASTM's "Manual of Industrial Water," a January 1953 release, prepared by Committee D-19. Manual discusses uses of industrial water, difficulties caused by industrial water, compositions of waters and deposits, treatment, sampling, analysis of water, identification of water-formed deposits.

Research by Hatch Gives New Basic Facts on Threshold Treatment for Corrosion Control

Research papers by Dr. G. B. Hatch of Calgon, Inc., titled "Protective Film Formation with Phosphate Glasses" and "Inhibition of Galvanic Attack of Steel with Phosphate Glasses" provide a better scientific understanding of the mechanism of film formation with Calgon.

Data prove Calgon stops corrosion by virtually eliminating flow of current between anode and cathode in corrosion cells.

Research shows Calgon is a cathodic inhibitor. All cathodic inhibitors are "safe" inhibitors, because they do not increase tendency toward pitting.

Data reveal that protective film is formed by electrodeposition process, and that Threshold Treatment for corrosion is quite different from Threshold Treatment for scale prevention.

Write if you want a free copy of these fundamental papers.

Industrial Water Statistics

According to U. S. Dept. of Commerce statistics, use of industrial water for process has been estimated at 80 billion gal per day during 1950. This is 8 times the quantity required in 1900, although population increase in same 50 years was only 2-fold.

Manufacture of steel, production of electric power require 50 billion gallons of the 80 billion per day. Industrial use of water is estimated to increase 170 per cent from 1950 to 1975, according to Materials Policy Commission.

Pilot Plant Designed for Steel Company Results in Minimum Cost for Waste Disposal

A Pennsylvania steel company had to dispose of wash waters evolved in the manufacture of producer gas.

This wash water contained objectionable quantities of phenol, sulfide, and cyanide.

Preliminary study showed that either chemical treatment, or closing up wash water system could do the job. A Hall Labs staff engineer recommended use of a pilot plant to determine chemical treatment costs. He specified equipment for pilot unit, and provided detailed instructions for operation. Pilot plant showed that all hydrogen sulfide and cyanide and about 90% of phenol could be removed.

But cost analysis of chemical treatment revealed it was 2 or 3 times as costly as closing up system. On this basis, decision was to install a recirculating system for the producer gas wash water.

Major problem in closed system was build-up of suspended solids. Methods of controlling this were studied by the Hall staff, and recommendations made to steel company.

State antipollution requirements were satisfied, and another step taken toward clean natural streams with the minimum cost to industry.

Field Reports on Industrial Water Treatment

Herman Reda, Service Engineer in our Detroit Office, made the following report on a food processing plant in his area:

"Turbines have now operated continuously for 3½ years. Prior to use of Hall System, plant had to clean units every 6 months."

A report on boiler water control comes from Bill Pfeiffer of the St. Louis Office. Report concerns a paper company:

"Client is pleased with silica treatment. After silica had been fed for about 3 months, boilers were opened for inspection, found to be much cleaner than client ever saw before. Heavy sludge usually found in top rear drum and mud drum was almost gone. Silica is also helping out at the filters, and filtered water contains no suspended matter. Client cleaned filters with Buromin—pleased with results."

"Calgon" and "Buromin" are names of phosphate glasses developed by Hall Laboratories for industrial water treatment and marketed, respectively, by its associates, Calgon, Inc., and the Buromin Company who have registered the names in the U.S. Patent Office as trademarks. "Hall System" is similarly registered as a service mark by Hall Laboratories.

Industrial Water Problems Require Special Handling

There are no "stock answers" to industrial water problems. For information, write, wire or call Hall Laboratories, Inc., P.O. Box 1346, Pittsburgh 30, Pennsylvania.

Water is your industry's most important raw material. Don't waste it.

HALL LABORATORIES, INC.—CONSULTANTS ON PROCUREMENT, TREATMENT, USAGE AND DISPOSAL OF INDUSTRIAL WATER

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Complete Seating Contact!

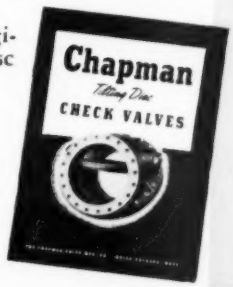
You know you've got it with . . .

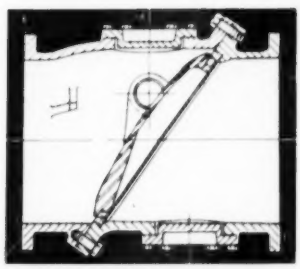
CHAPMAN

Exclusive TILTING DISC *Check Valve*

Nothing can "unseat" the disc-ring of this valve from its *drop-tight* contact with the body-ring . . . because clearance at the hinge-pins means that this contact is *complete.* There is no sliding action, consequently no wear, no leakage. And the pivoted disc is cushioned to an easy, silent closing . . . without slam . . . in installations that don't have unusual piping arrangements.

What's more, hydraulic laboratory tests at a top engineering school prove that the specially designed disc and streamlined valve-body reduce head loss as much as 80% under conventional swing-type check valves. See the graphs of these tests . . . and illustrations of the unique construction features of Chapman Tilting Disc Check Valves . . . in Catalog No. 30 (yours for the asking). *Write.*





Cross-section of the Chapman Tilting-Disc Check Valve. A feature of the design is that the disc seat lifts away from the body seat when opening, and drops into contact when closing, with no sliding or wearing of the seats.

THE CHAPMAN VALVE MFG. CO.

INDIAN ORCHARD, MASSACHUSETTS

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IN 20 YEARS — NO STUCK RINGS

...for Tulia, Texas, Diesels lubricated with Texaco Ursa Oil

FOR 20 years, the power plant for the City of Tulia, Texas, has been operating a 550 h.p. Fairbanks-Morse Model VA Diesel – lubricated exclusively with one of the famous *Texaco Ursa Oils*. Never once has there been a stuck ring. Regular inspections and major overhauls have invariably found the engine exceptionally clean. Wear has been slight, maintenance costs very low.

Thus, when the City of Tulia installed two new Model 31 Fairbanks-Morse Diesels in 1949, it was only natural that the lubricant chosen should be *Texaco Ursa Oil*. All three engines are running perfectly.

There is a complete line of *Texaco Ursa Oils*. Whether you're operating Diesel, gas or dual-fuel engines, you can get a *Texaco Ursa Oil* exactly right to give you top performance at lowest possible operating cost. That is one reason why –

For over 15 years, more stationary Diesel h.p. in the U. S. has been lubricated with Texaco than with any other brand.

Let a Texaco Lubrication Engineer help you get greater efficiency and worthwhile savings from *your* operation. Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write The Texas Company, 135 East 42nd Street, New York 17, N. Y.

TEXACO

TEXACO URSA OILS

FOR ALL DIESEL, GAS AND DUAL-FUEL ENGINES

TUNE IN . . . TEXACO STAR THEATER starring MILTON BERLE, on television Tuesday nights. METROPOLITAN OPERA radio broadcasts Saturday afternoons.

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